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Basic Technologies for FY90 Future Industries Program Outlined

91FE1012A Tokyo JITA NEWS in Japanese Oct 90 pp 4-10

[Article by Office of Director for Planning of Basic Technology for Future Industries, Agency of Industrial Science and Technology, MITI]

[Text] **1. Basic Technologies for Future Industries Program**

Technological innovation is the motivating force behind technological development. It serves as the momentum for disclosing the future for today's industrial world. Restrictions on resources are especially great in Japan; therefore, technological development becomes extremely important to improve the living standards of the people while maintaining social vitality. In its March 1980 report, MITI's Industrial Structure Council also pointed out "MITI's ideal policy for the 1980s" and that the development of a policy for the "establishment of an economical safety assurance" and the "establishment of a state based on technologies" was indispensable if a country like Japan was going to deal successfully with its weakness. Therefore, in 1981 MITI's Agency of Industrial Science and Technology inaugurated the "Basic Technologies for Future Industries Program" as a concrete policy for complying with MITI's ideal policy. This program has been promoting the development of the innovative basic technologies that are indispensable for the establishment of future industries such as aerospace, information processing and biotechnology, and for upgrading the level of extensive existing industries. Japan's technology has reached the international standard in the phases of application and development; however, a majority of these technologies are the result of actively promoting technologies from countries in Europe and America: Japan is still behind in the basic and innovative development of technologies. Amid the intensification of trade friction, the severity of which is increasing in the international environment, it has now become urgent that Japan promote R&D on basic technologies with far-reaching effects in extensive fields as part of Japan's active contribution to the world economy, and we believe that this program will comply with the demand.

2. Outline

a. R&D Fields

In 1990, taking the following points into consideration, in addition to continuing R&D in 13 topics representing 4 fields (superconductivity, new materials, biotechnology and new functional devices), we have decided to initiate the R&D of new software structured models.

(1) They shall be basic technologies representing very strong innovations, the far-reaching effect shall be great, and they shall cover a wide range.
(2) Since their R&D will require approximately a 10-year period and the funds required will be great, they shall be technologies with a high R&D risk.
(3) They shall be technologies whose applications to future industries are clear, to a certain degree, e.g., technologies for which R&D has already been started in advanced countries of Europe and America, etc.

b. R&D Systems

The following are R&D systems:

(1) As a rule, along with adopting the "parallel development system," in which R&D is carried out simultaneously by a number of research agencies and systems,
(2) prepares a general R&D plan, evaluating the R&D conditions and results upon comparison with the development target set in the master plan and promoting the rationalization of R&D execution.

c. Execution System—Cooperation Among Industrial, Governmental and Academic Circles

This program has been promoted through the cooperation of three circles: the industrial circle (enterprises, etc.), governmental circle (national test laboratories) and academic circle (universities, etc.). In other words, national test laboratories are conducting R&D as well as entrusting R&D to civilian enterprises in order to take full advantage of the potential in the industrial world. In addition to gaining cooperation from the academic circle through sessions held by the evaluation committee, promotion committee, etc., consignments are also made to universities.

d. Number of Patent Cases

The promotion of R&D has been smooth up to now. As of the end of fiscal 1989, there were 309 patents, and the number of published papers in academic circles, domestically and abroad, reached 6,997.

An effort is made to diffuse the R&D results both domestically and abroad through the annual "Basic Technology for Future Industries Symposium (open symposium)."

3. Outline of Various Topics

(1) Superconducting Materials and Devices

Technologies involving design and production processing to promote the performance improvement of superconducting materials will be developed together with an explanation of the mechanism through the material evaluation of superconducting materials and the search for materials that maintain a superconductive state under high temperatures, high current and high magnetic fields. In addition, the development of a new production process for the film thinning and polycrystallizing of superconducting materials will be conducted.

Devices that have become realizable for the first time by employing a superconducting material, such as the

superconducting transistor, will be developed as superconducting devices. Elemental technologies such as fine processing will be developed for this purpose.

In 1990 the development of thin film fabrication technology will be made by using ionized oxygen to promote the improvement of the quality of superconducting thin films; the development of a new material synthesis technology, necessary in the search for new high temperature superconducting materials, will also be attempted. Basic technologies, such as the fine processing technology necessary for device fabrication, will be developed for superconducting devices, along with the theoretical explanation of superconducting device actions in order to develop superhigh speed devices and new functional devices that use superconducting materials.

(2) Fine Ceramics

Fine ceramics, which are structural materials with such characteristics as high strength under high temperatures, high corrosion resistance, and high wear resistance will be developed for application to coal gas ceramic turbine parts.

The development and upgrading of the elemental technology wil be promoted for large, intricately-shaped model parts in 1990. In addition, an evaluation technology used to conduct a 10,000 hour continuously running test of the delayed rupture strength (strength against long period load) will be established to evaluate material and fabrication processes based on large and intricately-shaped model parts.

(3) High Efficiency Polymer Separation Membrane Materials

High efficiency polymer separation membrane materials with innovative functions, which are also applicable to materials for which separation has been technically difficult in the past, will be developed to promote efficiency and energy conservation of the separation process in the chemical industry.

During the improvement and upgrading of the membrane materials and membrane fabrication technology, an evaluation will be made of the improvement in membrane separation performance, stability and durability, and a high efficiency separation technology will be established.

(4) Electroconductive Polymer Materials

Electroconductive polymer materials, which are polymers (generally an insulating material) that have electroconductivity the same as that of metals and possess such characteristics as light weight, corrosion resistance and ease of workability, will be developed.

In 1990, while the synthesis, processing and treatment technologies of electroconductive polymers are being improved, an evaluation will be made of the improvement of electroconductivity, and technologies involving electroconductivity and stability will be established.

(5) High Crystalline Polymer Materials

High crystalline polymer materials with strength equivalent to that of metals will be developed as structural materials while taking full advantage of such polymer material characteristics as light weight, corrosion resistance, ease of workability and insulation properties.

In 1990, while the forming technology is being upgraded, an evaluation will be made of the improvement of the mechanical characteristics and a crystallinity technology will be established.

(6) Highly Resistant Advanced Materials

Together with the development of reinforced fibers, a compositing technology will be developed for carbon system base metals and intermetallic compounds for materials that are lightweight, strong, and resistant to heat, oxidation, and corrosion.

In 1990 various carbon fibers and carbon system base metals excelling in oxidation resistance and the compositing and forming technologies using these characteristics were slated for development.

(7) Light Reaction Materials

Light reaction materials usable for ultra-high density information recording will be developed by making use of the photochromic effect in which color changes when exposed to light and returns to the original color when exposed to another color or when heated, and by utilizing the photochemical hole burning (PHB) effect in which an abnormal absorption is exhibited when exposed to light.

The improvement of recording precision and stability were to be promoted in 1990 by structural control and the synthesis of new materials. In addition, development of a recording technology up to the liquid nitrogen temperature and its long period stabilization technology was slated for PHB materials.

(8) Nonlinear Photoelectron Materials

Materials exhibiting nonlinear engineering phenomena ((1) changes in refractive index according to light energy, (2) incident light transmitted by wavelength differing from that of the incident light, (3) conducts light amplification) will be developed. Optical information processing, which combines these nonlinear phenomena with laser light, is capable of using the high speed and parallelling properties of light, and the processing volume and speed will increase by leaps and bounds when compared with those attained up to now.

The development of technology to evaluate the structure and performance of materials necessary for materialization technology was planned for 1990, as well as a search for new materials.

(9) Recombinant DNA Utilization Technology

Recombinant DNA technology which will create new microorganisms capable of producing useful materials highly efficiently will be developed to put into practice the processing technologies of the chemical industry.

The adaptability of new organisms to industry was to be evaluated in 1990, and an optimum culturing method was to be established to promote the productivity improvement and stabilization of the new microorganisms that have been created so far.

(10) Functional Protein Aggregate Application Technology

Higher order functions (material/energy conversion function, material recognition/transmission function) which organisms possess are produced by a complex combination of the lipid membrane and the compound reaction of the numerous functional proteins which serve as the reaction field for the lipid membrane. Therefore, a functional protein aggregate with such a composite/multistage reaction system will be reproduced outside the organism to make use of the higher order functions possessed by such organisms.

A new analysis/evaluation method was slated for development in 1990, and the search for methods to separate, purify, orientate and stabilize the functional protein aggregate will be promoted.

(11) Superlattice Devices

Devices having superhigh speed, superhigh frequency oscillation and amplification exceeding the functional limits of conventional devices will be developed by using superlattice materials with crystalline structures in which isomeric materials have been laminated through control at the atomic level.

Demonstration superlattice devices with superhigh speed and superhigh frequency functions were to be trial manufactured in 1990. The realization of higher efficiency of the devices will be promoted based on the results of the trial manufacturing.

(12) Three-Dimensional Circuit Elements

Three-dimensional circuit elements with accumulated alternate semiconductor imtegrated circuits and insulation layers will be developed so that devices capable of high speed operation, large capacity realization and parallel processing exceeding the limits of conventional devices can be developed.

Full-scale demonstration three-dimensional circuit elements with high accumulation and functions will be trial manufactured in 1990. The realization of devices demonstrating higher efficiency will be promoted based on these results.

(13) Bio-Devices

Bio-devices which, through engineering, realize some of the superior functions of organisms, will be developed by defining the manifestation mechanism of the information processing function of organisms.

The organism information processing function model will be constructed in 1990 by using the results of measuring various nerve functions. In addition, simple demonstration devices will be trial manufactured.

(14) New Software Structured Model

An innovative software structured model capable of complying flexibly and opportunely with changes in the environment will be developed by multiple agents through cooperative problem solving.

Studies of the basic mechanism of the cooperative structure will be started along with studies of requirements for optimizing the cooperative system, and the basic modeling of the cooperative system will be initiated based on these studies.

Table 1.

Superconductivity (1 topic)	Superconducting materials/Superconducting devices
New materials (7 topics)	Fine ceramics High efficiency polymer separation membrane materials Electroconductive polymer materials High crystalline polymer materials Ultra environment resistant advanced materials Light reacting materials Nonlinear photoelectron materials
Biotechnology (2 topics)	Recombinant DNA utilization technology Functional protein aggregate application technology
New functional devices (3 topics)	Superlattice devices Three-dimensional circuit elements Bio-devices
Software (1 topic)	New software structured model

Table 2. Budget Transition

R&D Fields	Budget for FY81	Budget for FY82	Budget for FY83	Budget for FY84	Budget for FY85	Budget for FY86	Budget for FY87	Budget for FY88	Budget for FY89	Budget for FY90
Supercon-ductivity								1,061	1,872	2,347
								(325)	(780)	(1,437)
New materials	1,356	2,596	3,191	3,258	3,593	3,572	3,538	3,144	2,807	3,000
						(868)	(1,191)	(1,088)	(1,288)	(2,538)
Biotech-nology	675	1,043	1,191	1,201	1,252	1,220	1,085	938	817	472
New functional devices	673	1,128	1,451	1,478	1,585	1,542	1,404	1,209	1,311	756
Software										53
Total	2,714	4,786	5,850	5,952	6,445	6,513	6,043	6,368	6,836	7,463
						(869)	(1,193)	(1,416)	(2,072)	(3,978)
Growth rate	-	+76.3	+22.2	+1.8	+8.3	+1.1	-7.2	+5.4	+7.3	+9.2

(Unit: Million of yen)

(Note: Figures in ( ) are special account funds and are included in the figures without ( ). Office expenses are included in the total of the figures in ( ).

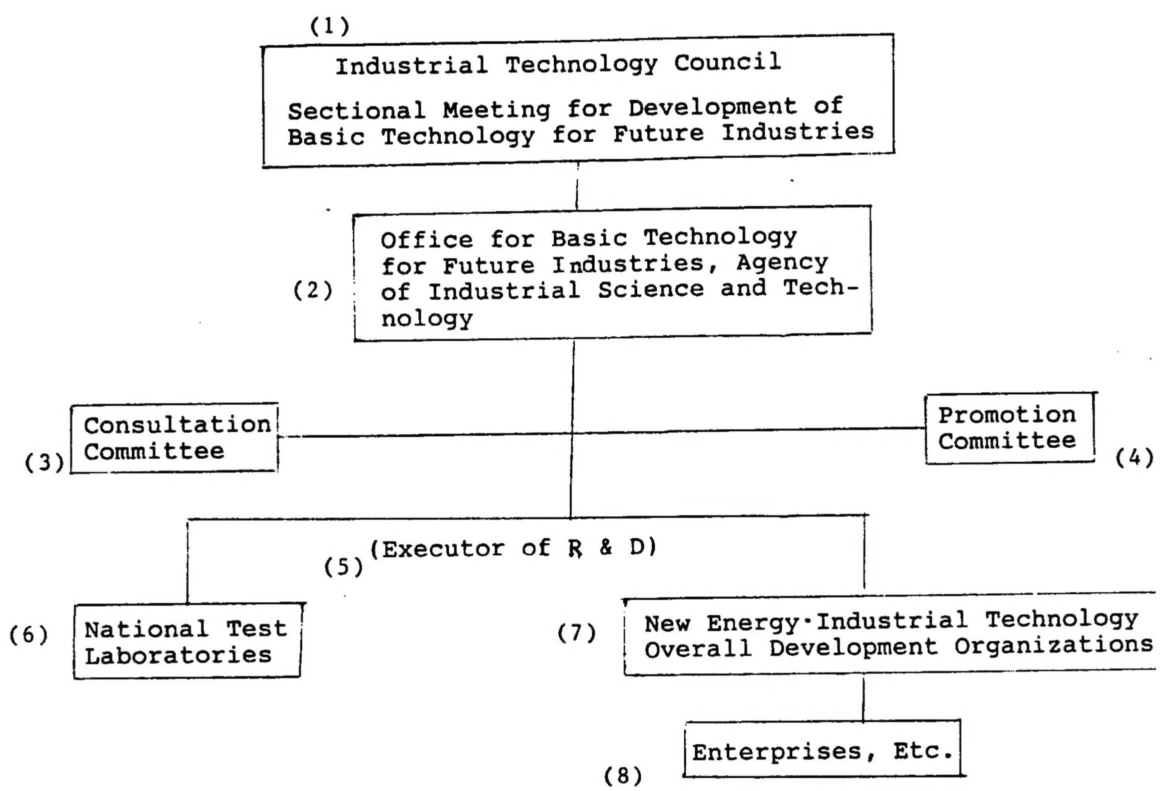

Figure 1.

Table 3. Execution Setup of R&D of Basic Technology for Future Industries

		1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Superconductivity	Superconducting materials and superconducting devices								Search for materials, studies on fabrication process technology and evaluation method, development of devising basic technology I				Improvement of material performance, fabrication process technology, establishment of evaluation method, trial manufacture simple demonstration devices II			Upgrading materials, establishment of fabrication process technology, measurement, evaluation, trial manufacture of full-scale demonstration devices III			
New materials	Fine ceramics	Development and evaluation at testpiece shape I			Development and evaluation at simple model parts II				Development and evaluation of large-sized complicated shape model parts III			Achievement of target performance value in model parts IV							
	High efficiency polymer separation membrane materials	Elucidation of membrane separation mechanism I				Development of membrane materials, membrane fabrication, processing technologies II			Further improvement and evaluation of performance III										
	Electroconductive polymer materials	Elucidation of electroconductive mechanism, search for materials I				Improvement of electroconductivity, development of processing technology II			Further improvement and evaluation of performance III										
	High crystallization polymer materials	Elucidation of relation between crystal condition and mechanical characteristics, search for materials I				Development of technologies of high orientating crystal polymerization, etc. II			Further improvement and evaluation of performance III										
	High efficiency crystal control alloys																		
	Composite material																		
	Light reaction material					Elucidation of light reaction mechanism, search for materials I				Improvement of material performance, development of processing and fabrication process technology: thin filming, etc. II		Upgrading and evaluation of processing and fabrication process III							
	Ultra environmental resistance advanced materials									Search for materials, studies on development and evaluation methods of fabrication process technology I				Upgrading of materials, establishment of fabrication process technology and evaluation method, measurement and evaluation II					
	Nonlinear photo-electron materials									Search for materials, development of synthesis method, etc., and studies on evaluation method I				Improvement of material characteristics, establishment of evaluation method II			Upgrading of materials, measurement, and evaluation III		
Biotechnology	Bioreactor																		
	Cell mass culturing technology	Basic research on culturing conditions, etc. I			Development of high density culturing technologies such as nonserum medium II			Improvement and evaluation of productivity, etc. III											
	Recombinant DNA utilization technology	Search for gene/vector and elucidation of relation between these structures and functions I				Alternation of gene-vector and search for optimum host II													
	Functional protein aggregate application technology									Extraction, separation, purification, change of protein, etc., development of artificial materials, analysis, evaluation of organism aggregates I				Improvement of protein and artificial materials, reorganization of aggregates and evaluation of artificial aggregates II			Integration and upgrading of aggregates and evaluation of artificial biomembranes III		
New functional devices	Superlattice devices	Development of materials and devising basic technology I				Trial manufacture and evaluation of simple demonstration devices II			Trial manufacture and evaluation of full-scale demonstration devices III										
	Three-dimensional circuit elements	Development of devising basic technologies such as crystal lamination and vertical wiring, etc. I				Trial manufacture and evaluation of simple demonstration devices II			Trial manufacture and evaluation of full-scale demonstration devices III										
	Environmental resistance reinforced devices																		
	Bio devices						Construction of information processing functional model of organism, development, evaluation of bio device basic technologies: trial manufacture of simple demonstration devices I					Upgrading of information processing functional model of organisms, trial manufacture, and evaluation of full-scale demonstration devices II							
Software	New software structured model																		
	Budget total (Including office expenses, etc.)	2714	4786	5850	5952	6445	6513(869)	6043(1193)	6368(1416)	6836(2072)	7463(3978)								

-Unit: Million yen -Figures in parentheses are special account funds and are included in the budget total.

Table 4. Execution Setup of R&D for Basic Technology for Future Industries

Topic	Main Civilian Executors	National Test Laboratories
Superconducting materials/superconducting devices		National Research Laboratory of Metrology National Chemical Laboratory for Industry Research Institute for Polymers and Textiles Electrotechnical Laboratory Government Industrial Research Institute, Nagoya Government Industrial Research Institute, Osaka
(Superconducting materials)	(Foundation) International Superconducting Industrial Technology Research Center	
(Superconducting devices)	(Foundation)New Functional Devices Research and Development Association	
Fine ceramics	Fine Ceramics Technical Research Association	Mechanical Engineering Laboratory National Chemical Laboratory for Industry Government Industrial Research Institute, Nagoya Government Industrial Research Institute, Osaka Government Industrial Research Institute, Kyushu Research Institute for Inorganic Materials
High efficiency polymer separation membrane materials	Polymer Basic Technology Research Association	National Chemical Laboratory for Industry Research Institute for Polymers and Textiles Industrial Products Research Institute
Electroconductive polymer materials		Research Institute for Polymers and Textiles Electrotechnical Laboratory
High crystalline polymer materials		Research Institute for Polymers and Textiles
Ultra environmental resistant advanced materials	(Foundation) Metals and Composite Materials for Future Industries Research and Development Association	National Research Laboratory of Metrology Mechanical Engineering Laboratory Industrial Products Research Institute Government Industrial Research Institute, Nagoya Government Industrial Research Institute, Kyushu Research Institute for Metal Materials
Light reaction materials	(Foundation) Polymer Materials Center	Research Institute for Polymers and Textiles Electrotechnical Laboratory
Nonlinear photoelectron materials		National Research Laboratory of Metrology National Chemical Laboratory for Industry Research Institute for Polymers and Textiles Electrotechnical Laboratory Government Industrial Research Institute, Osaka
Recombinant DNA utilization technology	Biotechnology Development Technology Research Association	
Functional protein aggregate application technology		National Research Laboratory of Metrology National Chemical Laboratory for Industry Fermentation Research Industry Research Institute for Polymers and Textiles Electrotechnical Laboratory
Superlattice devices	(Foundation) New Functional Devices Research and Development Association	Electrotechnical Laboratory
Three-dimensional circuit elements		Electrotechnical Laboratory
Bio devices		Electrotechnical Laboratory National Chemical Laboratory for Industry
New software structural model	Undecided	National Chemical Laboratory for Industry

Note: In addition to the entrustment given to Yokohama University for high efficiency polymer separation membrane materials to represent academic (universities, etc.) cooperation, cooperation is being obtained from major civilian executors and national test laboratories in the form of reentrustment, etc.

Table 5. "Basic Technology for Future Industries" Related Budget for 1990

Item	1990 budget	1989 budget
1. Superconductivity		
(1) Superconducting materials/devices	2,347	1,872
	(1,437)	(780)

Table 5. "Basic Technology for Future Industries" Related Budget for 1990 (Continued)

Item	1990 budget	1989 budget
2. New Materials		
(1) Fine ceramics	1,313	1,149
	(1,304)	(1,138)
(2) High efficiency polymer separation membrane materials	192	358
(3) Electroconductive polymer materials	162	295
(4) High crystalline polymer materials	126	235
(5) Ultra environmental resistant advanced materials	1,001	301
	(838)	(150)
(6) Light reacting materials	471	318
	(396)	
(7) Nonlinear photoelectron materials	540	151
3. Biotechnology		
(1) Cell mass culturing technology		360
(2) Recombinant DNA utilization technology	152	306
(3) Functional protein aggregate application technology	321	151
4. New functional devices		
(1) Superlattice devices	185	341
(2) Three-dimensional circuit elements	301	626
(3) Bio devices	280	343
5. Software		
(1) New software structured model	53	
6. Office expenses, etc.	18	29
	(3)	(3)
Total	7,463	6,836
	(3,978)	(2,072)

(Unit: million yen)

Note: Figures in ( ) are special account funds. In addition to the above funds, ¥340 million has been appropriated for a special account for the Japan alcohol monopoly's work involving high efficiency polymer separation membrane materials for use in developing the R&D results of basic technology for future industries and in the alcohol monopoly's R&D on membrane separation.

Special Report on Trade and Industry Policy Recommendations for 1990's

91FE0140A Tokyo TSUSAN JANARU in Japanese Sep 90 pp 12-34

[The following are articles in TSUSAN JANARU about the "Trade Policy Forecast" report]

[p 12—Introductory paragraph]

[Excerpt] On 5 July, the Industrial Structure Council issued a report entitled "Trade and Industry Policy Recommendations for 1990's" (the so-called "Trade Policy Forecast"). The report is subtitled "Toward Creation of Human Values for Earth Age." As this suggests, the report represents a major departure in the course of postwar Japanese economic policy. It is a departure from the fundamental emphases on economic efficiency and supply on which Japanese policy has been predicated to date and a move toward the realization of a higher national standard of living.

[p 13—Interview with Yoshiharu Kodama, vice minister of operations, MITI]

Tasks for 1990's; Trade Policy Forecast

[Text] [Question] What kind of decade do you think the 1990's will be?

[Answer] There will probably be a search for new political and economic order in the world of the 1990's in the context of new international situations. I also think it will be a time in which the whole human race tries to deal with common problems—such as our earth environment—from a global point of view. Japan will have to

contribute more actively to the international community, and will be pressured to make sweeping domestic reforms, as its economic position continues to rise and domestic and foreign economics are integrated.

Our value system, as Japanese, will also undergo change, and we will become increasingly concerned about living more bountifully, more in keeping with our economic achievements.

As the average age of the earth's population rises, we should think of the 1990's as a period for creating the societal infrastructure necessary for the coming new century. In connection with this, I think we should restructure our social capital, which has fallen behind, and work hard to create a new economic system that matches our new value system.

[Question] What are the main themes of the "Forecast for 1990's?"

[Answer] There are three main themes which are set forward as international trade and industry policy goals for the 1990's. One is to contribute more to the international community while moving ahead with our own domestic reforms. Another is to provide our citizens with a more rewarding and fulfilling lifestyle. And yet another is to make sure we have the necessary foundation or infrastructure for long-term economic growth.

In seeking to achieve these three goals, we must be continually careful to maintain a balance between them, but we also need to realize that these three objectives mutually reinforce and complement each other. The specific content of each goal is different, but they all involve the creation of new human values which are based increasingly in global perspectives, which is a goal of a higher order. Hence I think they provide a good set of principles for developing international trade and industry policy for 1990's.

[Question] How do you think the tasks or goals set forth in the "Forecast" will be addressed?

[Answer] The "Forecast" is a forecast for the entire 1990's, so each goal does require a settled long-term commitment, but to the extent possible, we would like to implement concrete policy measures as soon as possible.

In the realm of contributing more to the international community, for example, there are some specific things we can do. We should contribute to the Uruguay Round of GATT, promote greater mutual cooperation in the Asian-Pacific region, and give serious attention to our global environmental problems, including support for the "Earth Regeneration Project." In the area of a richer, fuller life style, we are already studying specific proposals for working shorter hours, rationalizing our distribution industry, and achieving commercial integration. These measures should be taken up as important policy measures for fiscal 1991. I also think we need to consider specific proposals for developing a center for high-level international research exchange in the fields of science and basic technology.

[Question] It would seem that MITI might have great difficulty implementing some of these measures, particularly in the area of providing a better way of life for us Japanese. What is your thinking on this?

[Answer] In many areas, of course, we must cooperate with other governmental ministries and agencies. MITI oversees a wide range of industrial activities and is working toward realizing greater consumer protection and consumer choice: seeing the wholesome development of service industries for the home; shortening working hours in small and medium businesses as well as in corporations; promoting the employment of more senior citizens; using industrial land more efficiently and safely; and implementing industrial land policies that encourage concentration toward Tokyo while promoting local economic growth. Hence, in the interest of public benefit, there are many tasks which we should address first at the level of industrial policy.

There are also cross-ministerial concerns where we will have to work closely with other ministries and agencies in implementing policy. Needless to say, MITI will do everything possible to promote such cooperation and coordination.

[p 14—Article by Eijiro Saito, chairman, Industrial Structure Council]

Formulating "Trade and Industry Policy Recommendations for 1990's"

[Text] This council has previously issued three 10-year forecasts entitled "Trade and Industry Policy Recommendations," for the 1960's, 1970's, and 1980's.

When the resolution to prepare the forecast was adopted last September, a 1990's Trade and Industry Policy Committee was formed within the council to oversee the work. Since then, more than 200 people, representing experts in all sorts of fields, have worked on the forecast, structured under seven subcommittees.

Lacking divine powers, it is no easy task to look ahead 10 years into the future. Nevertheless, thanks to the collected knowledge and labors of everyone on the committee, we were able to put together the Trade and Industry Policy Forecast for the 1990's under the banner title of "Creating Human Values for The Global Age."

We will witness great and rapid changes in the 1990's, both at home and abroad. It will be a critical decade in human affairs, demanding paradogmatic transitions, the formation of new socioeconomic and political orders, and the creation of new systems.

In this forecast we have set forth three major objectives for trade and industry policy for the 1990's: (1) to contribute more to the international community while moving ahead with our own domestic reforms, (2) to provide our citizens with a more rewarding and fulfilling

life style, and (3) to make sure we have the necessary foundation or infrastructure for long-term economic growth. We also posit seven basic approaches or attitudes necessary for the attainment of these objectives.

In the forecast we deal with many tasks—and measures for undertaking those tasks—which cover a wide range of fields and must be addressed with long-term measures. Many points still need further study. It is our hope that the forecast will spark vigorous debate in all quarters and that it will result in the formation of a wide consensus and the implementation of concrete active measures to achieve the objectives.

Finally, I wish to express my sincere appreciation to committee chairman Tsujimura and everyone else on the committee.

[p 25-26—Trade & Industry Policy Recommendations for 1990's—Summary]

[Text]

I. Trade & Industry Policy Recommendations for 1990's

Three Goals, Seven Basic Approaches

We may summarize the objectives of trade and industry policy for the 1990's as follows:

(1) Contribute more to the international community while moving forward with domestic reform

—Autonomous, creative contributions toward the free economic order and the future of mankind

—Enhancing the principles of freedom and fairness in the context of domestic system, programs, and practices

(2) Provide Japanese citizens with a more rewarding and fulfilling life style

—Restore the balance between the life of the individual, on the one hand, and the corporation and production, on the other

—Promote trade and industry policies which are more humane

(3) Make sure we have the necessary foundation or infrastructure for long-term economic growth

—Indispensably presupposes active contributions toward international economic community and a more fulfilling national life style

The specific content of these three objectives is different, but all three are connected with a loftier goal, namely the "creation of human values for the global age." We must continually balance these three objectives, and achieve an overall balance sum.

In achieving these goals, the following seven basic attitudes or positions will be very important:

—Giving priority to market principles and self-responsibility

—The pursuit of human values and social benefit

—The development of an integrated domestic and foreign policy

—The formulation of policies that are rooted in a long-term perspective

—Adaptability to change

—Continual self-evaluation and self-reformation

—Coordination between governmental organizations

II. Major Tasks for Trade & Industry Policy in 1990's

1. Contributing to International Community While Promoting Domestic Reform

The 1990's will be an era for building a new international economic order that will be in keeping with the changes marking the new world economy. It will also be the decade for working at the world level on problems facing all mankind collectively, such as the problem of preserving our earth environment. Japan will make autonomous, creative international contributions in these areas, working more closely than ever before with the nations of Europe and America.

Our international contributions and participation must be commensurate with Japan's growing economic presence, not only in the economic realm, but throughout a wide range of non-economic areas as well.

As domestic and foreign economic integration advances, it will be essential for us to initiate self-reform all across the board, in our programs, practices, institutions, and activities. In addition, all these aspects of our national life must become more transparent, and mutual exchange with the international community must be deepened.

In keeping with the ideals of freedom, democracy, and free-market economics, we must promote international contribution and self-reform in order to earn for Japan an honorable position in the world community.

In order to achieve these goals, we must address ourselves to the following tasks:

(1) Basic Tasks

[1] Creating and promoting a new international economic order

[2] Making our domestic institutions more transparent in the interest of greater international harmony

[3] Dealing with problems of imbalance between Japan and foreign countries

[4] Promoting harmonious private economic enterprises

—Promoting overseas business activity in context of international harmony

—Promoting direct investment in Japan from abroad

[5] Providing aid to the developing nations

[6] Working to alleviate East-West tensions

[7] Grappling with global problems

—Working to maintain and improve the global environment

—Working with other countries to resolve problems related to energy and natural resources

—Promoting techno-globalism

—Promoting projects which benefit all mankind

(2) Greater Priority on Cooperation Between Advanced Nations

(3) Greater Priority on Inter-Regional Cooperation

—Asian-Pacific cooperation

2. Providing More Rewarding, Fulfilling Life Style

Japan has achieved high economic growth and outstanding improvement in enhancing its financial services. In terms of the foundational conditions of national living standards, however, in some respects Japan has moved backwards, and is a long ways off from achieving the kind of fulfillment in life that provides vital motivation for today and hope for tomorrow.

If we ignore these conditions of our national life, we may expect the sense of isolation and closedness to spread throughout our society, especially in the context of the increasing disparities between the affluent and the non-affluent, and between regions. This will adversely affect human productivity and creativity.

In the 1990's, as the mean age of our society rises and our national values change, it will be essential for us to improve the basic conditions in the way we live and thereby restore a more rational balance between personal life and corporate concerns with productivity. And the achievement of a richer domestic life style goes hand in hand with the alleviation of imbalances between Japan and foreign countries, and with living up to international expectations in fulfilling our obligations toward the international community.

Trade and industry policy at MITI has to date enthusiastically addressed itself to problems relating directly to environmental and safety issues, to consumer issues, and to other issues of national life. But we have to do more, we have to give greater priority to this human perspective now, in all of our policymaking.

More specifically, the following issues will be addressed:

(1) Giving greater consideration to the consumer's point of view

(2) Providing workers with a more abundant, fulfilling life

(3) Making allowances for our aging society

(4) Supporting the advancement of women in the working world

(5) Dealing with land-use problems

(6) Providing better housing and life-related public facilities

(7) Promoting Tokyo centralization

(8) Promoting regional socioeconomic growth

(9) Encouraging corporations to be more socially responsible, make greater cultural contributions

3. Making Sure We Have Infrastructure for Long-Term Economic Growth

In order to contribute to the international economic community and enhance our way of life in Japan, it is absolutely essential that we provide our nation with the infrastructure or basic conditions necessary for long-term economic growth. This infrastructure must be made, moreover, in such a form as will fulfill these international and domestic demands.

In the 1990's, the quest for steady economic growth fueled by internal demand will continue to be a keynote of our economic policy. This decade promises to visit us with severe changes, however, about which we cannot be overly optimistic. In order to build a more vigorous and enduring society in this context, we must take a long-range view of things as we build and reinforce our economic infrastructure.

Achieving these goals will involve the following tasks:

(1) Industrial Structure

[1] Realizing a flexible, energetic industrial structure

[2] Maintaining a firm base (infrastructure) for manufacturing industries

[3] Dealing with problems involving distribution and service industries

(2) Invigorating Small-Medium Businesses as Cradles of Creativity

(3) Promoting Science & Technology, Information Age

[1] Promoting science and technology

[2] Promoting the information age

[3] Protecting intellectual property, promoting standardization measures

(4) Coping With Changing Natural-Resource, Energy Situation

(5) Maintaining Stable Work Force

(6) Providing Efficient, Balanced Financial Mechanisms

(7) Building Up Social Assets for Economic Foundation (Infrastructure)

(8) Enhance Capability To Handle with Various Emergencies

[p 29—Article by Yasushi Kozai: "Drafting Subcommittee Report"]

Four Factors in International Economics

[Text] There are four points to this report. The first is the clear way in which international trends are forecast. We are able to entertain some bright hopes for the 1990's, such as the demise of the East-West cold war, and the realization of a global economy without economic borders. At the same time, however, we are pressed to find solutions to such global problems as continuing protectionist pressures on an international scale, and the perennial problems concerning energy and the environment.

The second point is the formulation of a basic philosophical framework for understanding Japan's place in the world community. It is argued that we are a "faceless nation," economically powerful but having no definite values and not clear about the direction we are moving in. In the framework that is here formulated, there are four subpoints: (1) holding in common the basic tenets of the free wold nations (liberty, democracy, and a market economy based thereon), (2) renouncing war, as set forth in the Japanese constitution, (3) functioning as a bridge for the developing nations to smooth their transition to advanced nation status, by means of cooperating, as an Asian nation (and especially as one which developed quickly into a modern nation despite its late industrialization) with the advanced nations of the West, using our economy to good advantage, which has contributed to the development and maintenance of the international system, and (4) taking broad initiatives to stabilize the international community. As principles of economic aid, the report points specifically to the importance of supporting autonomous development in the developing countries, helping to raise the standard of living (providing for basic social needs) in those countries, and backing their efforts to build the basic societal support system (infrastructure) necessary for economic growth.

The third point concerns the policies formulated to achieve the basic principles reflected in the first two points. Japan is now entering an age in which it must resolutely take the initiative in meeting its now understood obligations to work toward world economic stability. In working to achieve such stability, in addition to providing aid to the developing nations, we must also cooperate in the fields of trade and industry with East Europe, Central America, the NIES, and, if necessary, even with the advanced nations. We must also move resolutely to take initiatives for the success of the Uruguay Round. And we need to work to integrate and coordinate all economic polices, particularly as we see more and more correlation between the individual economic policies affecting each nations' macro economy, development, trade, and finance. It would also be a worthwhile endeavor to study ways of reaching international accord, in as many fields as possible, to resolve our structural differences.

The fourth point is seen in the detailed delineation of ways to approach foreign relations region by region. Japan must now, more than ever before, cooperate more resolutely with other countries and work toward the creation of multi-layered relationships of trust in the international community. Toward this end, strengthening our ties with the United States is of course essential, but no less essential is the tri-lateral cooperation between Japan, America, and Europe, or APEC (Asian-Pacific Economic Cooperation).

This report carries the subtitle of "Japan's Obligations and Initiative Concerning the New Century—Seeking Formation of Multi-Layered International Relations." This is an attempt to encapsulate, in a few words, the new principles set forth in this report and discussed above.

[p 30—Article by Naosaburo Kimura]

[Shifting Priority from Production to Living

[Text] I think the overall thrust of the "interim report" issued by the Abundant Life Policy Subcommittee can be summed up in the slogan "shifting priority from production to living." This shift from "production" to "living" may truly represent a major turning point in postwar Japanese cultural history.

Advocating such a shift of course opens one up to certain counterarguments. Won't this ruin Japan's economy? We worked like beavers in the face of poverty, making things and marketing them overseas; that's the formula that has made Japan prosperous. Are we now going to take everything we've worked so hard to build and squander it in the name of giving priority to "living?" These arguments have a certain plausibility. However, in my opinion, if we carry on indefinitely with the production-first mentality, as in the past, that is precisely what is going to ruin Japan.

As our technological civilization matured, in a real way, in the latter half of the 1970's, we began witnessing a tremendous decline in the sense of surprise, joy, and delight which each new technology and each new industrial
product could produce in us. People now clamor for high-class merchandise, for the real article. But this only reflects the fact that people are focussing their interest on products that can give them a genuine sense of delight, precisely because we no longer see any great progress in

functionality, efficiency, or economy. The Chinese ideograph for "new" has lost its charm for the first time in Japan since the Meiji era.

Our physical beings and our hearts are no longer delighted directly by technological civilization per se. To make up for this, we now invest more time and energy and money in ourselves. We are in a state of transition from being publicly and socially diligent to being individually and privately diligent. Increasingly we seek to minimize the time spent in business and working in the home and to maximize the time spent in pursuit of personal enjoyment.

This private diligence is not mere diversion or a matter of killing time. It is very serious play that is engaged in for one's own benefit. If work could simultaneously be turned into play, that—for modern man—would be the ultimate way to live. As long as we are doing something we want to, we can be as busy as humanly possible and still feel no pain. We can keep smiling without getting the least fidgety.

We can no longer tolerate the way we lived during the era of rapid economic growth, when we sacrificed today for the hope of tomorrow. The age of "living for today, not tomorrow" and of "give me the real, not the ideal" is upon us. We are neither apprehensive nor hopeful about tomorrow. We live each day in order to get the most out of it.

It is when we put our hands and feet and brains to work in creating our own lives that we begin to find the wisdom to build for tomorrow.

In the past, during the middle and late Edo eras (18th and 19th centuries), people lived primarily to enjoy themselves. This gave birth to the Edo lifestyle culture, with its culinary sophistication, kabuki, and yose (street theater). It was a time of great cultural flowering.

During this Edo era of play, Japanese aesthetic tastes and culture became more refined, and our educational level became the highest in the world. And this is precisely what paved the way for the Meiji reforms, and enabled Japan to quickly achieve modernization without becoming another European colony.

We are now faced with the dawning of a new era of investing in the future. The transition in our priorities "from production to living," and the attitudes which it reflects, will be indispensable to us as we pioneer our way into the 21st century. Our aspirations for a "fuller, richer, more abundant life" must be realized, even if it means losing just a bit of our edge in economic might.

[p 31—Article by Keiichi Konaga]

Broadening Horizons of Industrial Policy

[Text] Our industrial policy in Japan has been very flexible in changing its methods down through the years in response to the particular problems of each era, in keeping with each stage in our industrial development and the economic position then occupied in the international community. This has always been the product of our diligence as a people, and as an industrial society. But it has been coupled with good public policy in enabling us to achieve the unshakable position in which we now find ourselves.

Nevertheless, the tasks and problems now facing Japan are formidable. We need to resolve the land-use problem, to fashion a society in which our people can lead a more abundant life, to deal with our labor shortage, to correct imbalances between us and other countries, and to address global environmental issues. For these reasons, we are now entering policymaking waters that are very treacherous.

For nearly a year the Industrial Policy Subcommittee studied the possibilities for new industrial policy in this extremely demanding era. What we finally arrived at can be expressed as a need to "move beyond the emphases on economic supply and economic efficiency."

Upon reading this, many people might have serious questions: Does this mean we will no longer emphasize economic efficiency? And what exactly lies "beyond?" Our industrial policy now has two facets: On one hand, we will continue to emphasize the importance of conventional concepts; on the other, we will depart considerably from these concepts without ignoring economic efficiency. What it really boils down to is this: While maintaining the vigor of our industrial society and exploiting our economic efficiency, we will increasingly redirect our returns toward a more abundant life for our people. This signifies a realization of the fact that the fundamental purpose of corporate growth and economic development is to restore the balance between productive activity and richer, more fulfilling lives.

In order to achieve this, we need to expand the perspective of our industrial policy beyond the pursuit of economic efficiency in order to comprehend the entire world. We call this perspective "socioeconomic efficiency." This is where the future lies.

To put this into the context of corporate activity, it means that Japanese corporations must stop looking at the pursuit of economic efficiency as the only valid standard of value. Corporations must formulate a more pluralistic value system, one that responds to changing public values, to the advance of globalization, and to other socioeconomic changes. This should eventually result in the formulation of new concepts of efficiency.

In the 1990's we will have to make a concerted effort to pursue broader, more pluralistic goals than in the past. In some cases we may be obliged to pursue goals that seem mutually antagonistic or contradictory. This means that it is going to be more difficult than ever before to formulate good industrial policy.

But it is precisely in meeting this challenge that we will find hope and vitality for tomorrow. And I am very

hopeful that those engaged in hammering out our industrial policy will work courageously toward the goal of a Japan that, as an international nation, is a land of fulfillment and abundance.

[p 32—Article by Yoshiichi Ito]

New-Era Regional Promotion and Environment Policy

[Text] In the Subcommittee on Regional Promotion and Environment Policy, studies were organized under two working groups, namely the "Working Group on Regional Promotion" (chaired by Yoshiichi Ito, professor at Tokyo Women's College), and the "Working Group of Global Environment" (chaired by Yoichi Kaya, professor at Tokyo University). For dealing with the issue of Tokyo centralization, a "Special Working Group" was formed under the Working Group on Regional Promotion.

Working Group on Regional Promotion

As new principles for land use policy, we first cite the formulation of human-oriented policy measures, the reconfiguration of the social framework, and the implementation of comprehensive, long-term, integrated policy measures. Then, to promote regional prosperity, we advocate, firstly, stronger organic links and wide-area administrative functions between the major cities in order to form wide-area regional economic spheres, and secondly the formation of new industrial environments (including so-called "new factories," multi-use complexes, and industrial complexes) and the promotion of more attractive community-building by revitalizing old business districts, etc, in order to form more attractive regional economic societies.

As to the question of Tokyo centralization, we believe it necessary to complement the conventional support for the regional decentralization of various functions by limiting governmental support for large greater-Tokyo projects designed to reduce the pressure of influx into Tokyo, and by promoting better life-style support structures (infrastructure) in order to alleviate the problems caused by over-density.

On the land-use issue, in terms of industrial land-use policy, it is important that we strive to use our land resources in the best and least-wasteful way, and that we abandon the idea that land is a speculative asset. In conclusion, in this area, we point to the need to increase taxation on unused and marginally used land holdings.

Working Group on Global Environment

The problems facing our earth environment include the greenhouse effect, depletion of the ozone layer, acid rain, the desert expansion. The new countermeasures taken against these problems include doing studies on new human values and life styles, lending support to grassroots environmental protection activities, and coordinating industrial activity with global environmental protection.

The greenhouse problem is complicated by the fact that it is the inevitable consequence of human activity. This makes it a problem of a different dimension than other environment problems. Accordingly, we cite the necessity of increasing our understanding of the problem, in terms of the natural and social sciences. Beyond that, however, we need to seriously undertake a worldwide effort to restore the green earth. This will have to be a comprehensive, long-term endeavor, extending over the next 100 years. We also assert the necessity to initiate a worldwide campaign to devise and implement an "earth regeneration project." This project would involve the promotion of global energy conservation and the widespread use of clean energy.

[p 33—Article by Hiroyuki Yoshikawa]

Importance of Quality in S&T

[Text] I was honored to be appointed to the important position of chairman of the Industrial Technology Policy Subcommittee of the 1990's Trade and Industry Policy Committee within the Industrial Structure Council. I asked top people in various fields to serve on the subcommittee, and I believe we were able to hold very significant deliberations.

The current S&T scene is marked by two kinds of change. Firstly, the social significance of science and technology is changing. Secondly, the content of science and technology is changing very rapidly. These two kinds of change are combining to make ii difficult to understand just how science and technology will exert their influence on us in the future. And how are we now to guide science and technology? Such considerations make it very difficult to get things into proper focus. This was my personal view as the subcommittee began its work.

There is a very strong correlation between the environment in which science and technology develops and the nature of that science and technology itself. When international relations are very tightly knit, for instance, the correlation between science and technology, on the one hand, and the state of a nation, every nation, on the other, becomes so strong that each nation must make the promotion of science and technology the number-one priority of its national policy. Things are now to the point, in fact, where international relations themselves are conducted through the medium of science and technology, resulting in an international situation that, structurally, is extremely complex.

Faced with this situation, we can no longer comfort ourselves with the naive belief that our future continues to be bright so long as we simply go on promoting science and technology. I believe that we have entered an era in which it will be of critical importance to emphasize "quality" as we implement science and technology, and formulate S&T policy.

In this context, therefore, I felt the need to take a very broad multi-dimensional approach in our subcommittee as we deliberated such issues as what precisely we should

expect from science and technology in the future. In other words, in our present age, we must concern ourselves not so much with science and technology itself as with how science and technology will impact on the future of all mankind. The members of the subcommittee analyzed the complex circumstances now developing, sought to determine the significance of these circumstances, and thereby were able to grasp, in its larger flow, what directions science and technology ought to take in the future. The conclusions reached are, I think, very significant.

[p 34—Article by Toyoaki Ikuta]

Three Keys to Long-Range Energy Outlook

[Text] When we try to develop an outlook for energy issues that extends through the 1990's and into the first decade of the 21st century, I think there are three inherent keys. The first is energy conservation, the second is the earth environment, and the third is the securing of energy supplies.

Although the term "forecast" is indeed applied to our long-range energy forecast here, it would be more accurate to characterize it as a "plan" or as "policy guidelines." One feature of this forecast is in assuming a somewhat high economic growth rate. This rate, as an annual average, is taken as 4 percent through the 1990's, and as 3 percent during the first decade of the new century.

However, these high growth rates notwithstanding, we assume relatively low rates of increase in energy demand, specifically 1.6 percent annually during the 1990's, and 1.2 percent in the early 2000's. This results in an energy acquisition elasticity of 0.4.

In order to keep energy demand down to these levels, it will be necessary to reduce per-unit-GNP energy demand by 36 percent over the next 20 years. The first key, then, involves the question of whether or not this is really possible. During the 15 years since the oil crisis, the energy situation has stabilized on the surface, and we have returned to the socioeconomic behavior of using a lot of energy, just as before the crisis. To turn this situation around and move toward energy conservation will take more than urgent appeals. We must devise measures which are enforceable. If that is not possible, then a major premise of this forecast crumbles.

The second key concerns measures taken to thwart the greenhouse effect. As one measure, it is now urged that we reduce the amounts of CO_2 discharged into the atmosphere. This is closely related to trends in the consumption of fossil fuels.

In our forecast, again, we assume a large degree of energy conservation, as well as that nuclear power production will be very considerably increased. Even so, we still calculate that CO_2 emission will increase 16 percent through the 1990's, figuring right down to the limits of possibility. If a greater reduction in this amount of CO_2 emission is in fact demanded, then we will have to go back to the starting point and rework the entire framework or our forecast.

The third key is that of energy security. We assumed a large increase in the supply of alternate sources of energy in this forecast, including much higher levels of nuclear power. If this turns out to be impossible, then the balance of supply and demand will have to be adjusted by increasing the supply of oil. Such an eventuality will perforce lead to a greater energy-dependence, in Japan's case, on the Middle East. And that, in turn, will impact negatively on our energy security, which has been the linchpin in our energy policy ever since the oil crisis.

Japan's energy policy for the 1990's will be hammered out in terms of these keys, and since these keys are readily susceptible to tradeoffs, they are difficult to evaluate. This, however, is a task that we cannot shirk.

Space Development Program Detailed

916C1002A Tokyo SPACE ACTIVITIES COMMISSION in Japanese 16 May 90 pp 1-27

[Article by Space Activities Commission: "Various Development Programs; Reorganization of Facilities; Other Measures; Budgets"]

[Text] **Introduction**

Artificial satellites in space have been promoted in a wide range of fields, such as communications, broadcasting, navigation assistance, weather observation, earth observation and scientific observation, thus playing an indispensable role in our daily lives. In recent years, much has been expected of their applications to the space environment, and artificial satellites have been actively promoted by many nations worldwide, including Japan.

Japan has launched 45 artificial satellites successfully. The development of the H and M series rockets has been making smooth headway, virtually achieving the desired results with the successful launching of the stationary meteorological satellite "Himawari 3" by an H-1 rocket in September 1989; scientific satellite No 13, the "Hiten," by an M-3 S-11 rocket in January 1990; and the marine observation satellite "Momo 1b" by an H-I rocket in February 1990. In addition, with activities involving the space station program making steady progress, it can be said that Japan has now reached the stage where it is capable of contributing to international space development while promoting various projects over a wide range of fields.

In other countries, on the other hand, steady progress is also being made, such as with the establishment of the National Commission on Space and the promotion of the Manned Moon/Mars Probe Concepts in the United States and the steady manned space activities by the Soviet Union. In addition, a substantial agreement has been reached between Japan and the United States on R&D for artificial satellites and their procurement, which has been discussed by the two governments since last year.

In line with the spirit of the outline of Japanese space development policy revised in June 1989, the "Space Development Program" has been formulated based on the situations at home and abroad, the domestic progress in R&D and long-term perspectives concerning space applications.

In promoting these development programs, many valuable lessons obtained to date from developmental experience will be utilized with the integral cooperation of the organizations concerned.

The main points of this program, as opposed to the previous one determined on 15 March 1989, are as follows:

1. The development of scientific satellite No 16 (MUSES-B) shall be promoted, aiming for its enlargement and launch by an M-V rocket in 1994.
2. The development of the advanced earth observation satellite (ADEOS) shall be implemented, aiming at a 1994 launch with an H-II rocket, while, at the same time, promoting the development of observation equipment mainly for observing the stratosphere ozone and a greenhouse effect gas observation sensor mainly for observing carbon dioxide, both to be mounted on the satellite.
3. R&D shall be implemented for sensors to be used in the future to survey resources and which will be mounted on NASA's polar orbiting platform I due to be launched in 1996.
4. The development of an R&D satellite for use in the communications and broadcasting fields shall be implemented, aimed at a launch by an H-II rocket in 1995 or later.
5. The development of experimental devices for application in the U.S. Second International Microgravity Laboratory (IML-2) program shall be implemented.
6. R&D for an operation system for mounting on the Japanese experimental module (JEM) of a space station shall be implemented.
7. The development of an M-V rocket shall be implemented, aiming at a 1994 launch of its first model.
8. Launch target years shall be altered for the module for the space scientific experiment using a particle accelerator (SEPAC), the space station mount-type JEM, the space flyer unit (SFU), the engineering test satellite-VI (ETS-VI) and H-II test rockets 1, 2 and 3.

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I. Development Program for the Scientific Field

A. Development Program

1. Operation

a. Test planet spacecraft (MS-T5)

The test planet spacecraft (MS-T5) "Sakigake," launched in January 1985, shall be operated with a view to confirming the performance of the M-3 S-II rocket No 1, achieving an interplanetary orbit and exercising relevant techniques, such as attitude control and ultradistant communications.

b. Scientific satellite-10 (PLANET-A)

The scientific satellite-10 (PLANET-A) "Suisei," launched in August 1985, shall be operated with a view to implementing research involving interplanetary plasma inside the earth's orbit and observation of Halley's Comet in the ultraviolet area.

c. Scientific satellite-11 (ASTRO-C)

The scientific satellite-11 (ASTRO-C) "Ginga," launched in February 1987, shall be operated with a view to implementing the observation of the X-ray source of the central nucleus of the active galaxies and precise observation of various X-ray heavenly bodies.

d. Scientific satellite-12 (EXOS-D)

The scientific satellite-12 (EXOS-D) "Akebono," launched in February 1989, shall be operated with a view to implementing precise observation of the acceleration mechanism of auroral particles in the geomagnetosphere and auroral emission phenomena.

e. Scientific satellite-13 (MUSES-A)

The scientific satellite-13 (MUSES-A) "Hiten," launched in January 1990, shall be operated with a view to implementing research involving techniques for orbital precision orientation and control, and the high-efficiency data transmission necessary for planetary survey and, as part of it, test of lunar swing-by technology.

2. Development

a. Scientific satellite-14 (SOLAR-A)

The scientific satellite-14 (SOLAR-A) is intended for use in implementing high-precision image observation of solar flares during the next maximum solar activity period under the cooperation of Japan and the United States. The development of this satellite shall be continuously promoted, aiming at launching it, using an M-3 S-II rocket, into an approximate circle orbit at an altitude of 550 to 600 km in 1991.

b. Scientific satellite-15 (ASTRO-D)

The scientific satellite-15 (ASTRO-D) is intended for use in implementing the precision observation of X-ray images and X-ray spectra of various heavenly bodies in the deepest part of space. The development of this satellite shall be continuously promoted, aimed at launching it, using an M-3 S-II rocket, into an approximate circle orbit at an altitude of 500 to 600 km in 1992.

c. Scientific satellite-16 (MUSES-B)

The scientific satellite-16 (MUSES-B) is intended for use in implementing research involving a large precision expansion structure mechanism, etc., and radio astronomical observation as an ultralong baseline interferometer. The development of this satellite shall be continuously promoted, aimed at launching it in 1994 using an M-V rocket.

d. Geomagnetic sphere observation satellite (GEOTAIL)

The geomagnetic sphere observation satellite (GEOTAIL) is intended for use in implementing observation research involving the structure of the long, large tail area of the magnetosphere existing at the night side of the earth, and will require the cooperation of Japan and the United States, with the former in charge of the satellite development and the latter in charge of its launch. The development of this satellite shall be continuously promoted, aimed at a launch in 1992.

e. Space scientific experiments using a particle accelerator

The purpose of space scientific experiments using a particle accelerator is to clarify the auroral emission mechanism, movements of charge particles in a plasma, and the excitation of electromagnetic waves by irradiating a plasma and an electron beam. The preparation for the experiments shall be promoted, aimed at implementing repeated experiments utilizing the space shuttle due to be launched in 1990.

B. Research

With respect to the astronomical scientific observation satellite series, research involving the technologies necessary for observing various space radioactive rays in order to implement the study of astronomical phenomena related to the basic laws of physics and space creation and evolution will be conducted.

As for the earth peripheral scientific observation satellite series, research shall be implemented that will involve the technologies necessary for observing the structures of the upper-level atmosphere, ionosphere and magnetosphere plasmas and related experiments in order to clarify physical phenomena between the sun and the earth, and a study of the transition in the global environment will be conducted.

As for the moon/planet survey series, research involving various observation technologies and equipment shall be implemented in order to conduct studies of physical phenomena in interplanetary space the the creation and evolution processes of the moon, planets and their atmospheres.

II. Development Program of the Observation Field

A. Development Program

1. Operation

a. Geostationary meteorological satellite-4 (GMS-4) and geostationary meteorological satellite-3 (GMS-3)

The geostationary satellite-4 (GMS-4) "Himawari-4" launchedin 1989 shall be operated with a view to developing technologies to improve Japanese meteorological activities and meteorological satellites. As for the geostationary meteorological satellite-3 (GMS-3), its management shall be implemented and tests conducted as required.

b. Experimental geodetic satellite (EGS)

As for the experimental geodetic satellite (EGS) "Ajisai" launched in August 1986 to implement geodetic activities and geodetic experiments as well as to confirm the performance of the H-I rocket (two-stage) testing machine, its orbit shall be grasped and utilized.

c. Marine observation satellites 1 (MOS-1) and 1b (MOS-1b)

The marine observation satellites 1 (MOS-1) "Momo-1" launched in February 1987 and 1b (OS-1b) "Momo-1b" launched in February 1990 shall be operated with a view to establishing technologies common to artificial satellites for use in global observation, as well as to observe marine phenomena, mainly involving the colors and temperature of the ocean's surfaces.

2. Development

a. Earth resources satellite (ERS-1)

The earth resources satellite (ERS-1) is intended mainly for resources survey oriented observation for national land survey, agriculture, forestry and fishery, environmental protection, disaster prevention, coastal area monitoring, etc., as well as for the establishment of active-type observation technology. The development of this satellite shall be continuously promoted, aimed at launching it into solar synchronous orbit at an altitude of about 570 km in 1991.

b. Geostationary meteorological satellite-5 (GMS-5)

The geostationary meteorological satellite-5 (GMS-5) is intended to continue meteorological observation by satellite and improve technologies involving Japanese meteorological activities and meteorological satellites. The development of this satellite shall be continuously promoted, aimed at launching it into geostationary orbit with an H-II rocket in 1993.

In addition, in order to implement experiments using a repeater to be mounted on the satellite and intended to relay distress signals from ships, etc., to organizations for search and rescue, the development of the repeater shall be continuously promoted.

c. Advanced earth observation satellite (ADEOS)

The advanced earth observation satellite (ADEOS) is intended to make an international contribution toward monitoring global changes in the environment, maintaining and developing earth observation technologies for MOS-1, MOS-1b and ERS-1, developing the technologies necessary for the development of future-type satellites, such as the ADEOS, and for relaying earth observation data, and promoting international cooperation in the earth observation field. The development of this satellite shall be promoted, aimed at launching it into solar synchronous orbit at an altitude of approximately 800 km by an H-II rocket in 1994.

In addition, the development of observation equipment mainly for observing the stratispheric ozone and a greenhouse effect gas observation sensor mainly for observing carbon dioxide shall be implemented based on a review of the compatibility with the satellite mainframe.

3. R&D

Resources survey-use future-type sensor

The R&D for a future-type sensor for resources survey use to be mounted on NASA's polar orbiting platform-1, due to be launched in 1996, shall be implemented.

B. Research

With respect to the earth observation satellite series, studies shall be implemented involving various sensor-applied observation technologies for global environment and marine observation and information processing technologies and applications to various applied fields, such as those involving information analysis technology for resources survey, followed by a study of higher-precision measuring technology with respect to the geodetic activity field, etc. In addition, a study of the tropical rainfall measuring mission for rainfall observation from space shall be implemented, followed by a study of observation equipment to be mounted on the polar orbiting platform.

As for the meteorological satellite series, studies of technologies for satellite meteorological observation and analysis shall be conducted.

Also, with respect to a multifunctional, economic geostationary multi-purpose transportation satellite capable of responding to different applications, such as advanced meteorological observation activities, aviation safety activities, research and rescue activities for ships and aircraft and operation management activities for traffic concerns, a study shall be implemented in coordination with the organizations concerned that will consider a wide range of satellite utilization purposes.

III. Development Program for the Communications Field

A. Development Program

1. Operation

a. Communications satellites-3 (CS-3a and CS-3b)

The communications satellite-3a (CS-3a) "Sakura-3a" launched in February 1988 and communications satellite-3b (CS-3b) "Sakura-3b" launched in September

1988 shall be operated with a view to continuing the communications services handled by the communications satellite-2 (CS-2), coping with increasing and diversified communications demands and promoting the development of technologies concerning communications satellites.

b. Broadcasting satellite-2b (BS-2b)

Broadcasting satellite-2b (BS-2b), which was launched in February 1986, shall be operated to promote the development of technology related to broadcast satellites, as well as to attempt to eliminate television broadcast difficulties.

2. Development

a. Broadcasting satellites-3 (BS-3a and BS-3b)

The broadcasting satellites-3 (BS-3a and BS-3b) are intended to continue the broadcasting services of the broadcasting satellite-2 (BS-2), cope with the increasing and diversified broadcasting demands and develop broadcasting satellite-related technologies. The development shall be continuously implemented, aimed at launching the former with an H-I rocket into a geostationary orbit near 110° East with respect to the BS-3a in 1990, and the latter, with the same rocket, into the same orbit at the same longitude.

b. R&D satellite for the communications/broadcasting fields

The R&D satellite for the communications/broadcasting fields is intended to continue working on the technical developmental problems handled by the communications satellite-4 (CS-4) involving advanced mobile satellite communications technology and multifrequency band integration technology, integrate the technical developmental problems of the experimental data tracking and relay satellites, such as intersatellite communications technology and advanced satellite broadcasting technology, and develop, experiment with, and demonstrate these technologies. The development of this satellite shall be implemented, aiming at launching it with an H-II rocket in 1995 or later.

B. Research

With respect to the communications/broadcasting/navigation satellite series, research involving technologies for communications with mobile objects, such as ships and aircraft, and for navigation assistance and control shall be implemented, followed by research of the improved performance of technologies involving communications and broadcasting satellites.

IV. Development Program for the Fields of Space Environmental Applications and Manned Space Activities

A. Development Program

1. Development

a. First material processing test (FMPT)

The development of an experimental system and the training of scientific crew engineers shall be continuously promoted, aimed at a 1991 implementation of the first targeting material processing test "Fuwatto '91," intended to implement material experiments utilizing space characteristics by a Japanese scientific crew engineer in a space shuttle.

b. Space station mount-type experimental module (JEM), etc.

With respect to the space station project for constructing, through international cooperation, a permanent manned space station in a low earth orbit, the development of a space station mount-type experimental module (JEM) for material experiments, life science experiments, scientific global observation and communications experiments shall be continuously promoted, incorporating the cooperation of industry, academia and the government, aimed at a 1997 launch with a space shuttle. The development of JEM shall be conducted in keeping with the "Space Station Cooperative Agreement for Interim Settlement" (same agreement will be applied after the "Space Station Cooperative Agreement" goes into effect).

In addition, the development of a space experiment-use compact rocket (TR-IA) intended to contribute to the development of space experiment common technology for the JEM shall be continuously promoted.

c. Space flyer unit (SFU)

The space flyer unit (SFU) is a reusable unit intended to secure opportunities for space experiments to implement scientific and engineering experiments, various scientific studies, such as astronomical observation and the development of various advanced industrial technologies, and to improve the reliability of the exposed area of the JEM and the common experimental equipment to be mounted. The development of the unit shall be continuously promoted, aiming for a 1993 launch by an H-II rocket.

d. First International Microgravity Laboratory Program (IML-1)

The United States' first International Microgravity Laboratory Program (IML-1), due to be initiated in 1990, shall be participated in to implement material processing tests, etc., prior to the FMPT "Fuwatto '91" in order to accumulate space environment application technology necessary fo experiments in space stations.

e. Second International Microgravity Laboratory Program (IML-2)

The development of experimental equipment to be mounted shall be promoted, aiming at implementing material processing tests by participating in the United States' second International Microgravity Laboratory Program (IML-2) due to be initiated in 1992 as part of

the Space Station Program, following the participation in IML-1, in order to accumulate data and technologies necessary for space environment applications and manned space activities in terms of the development of the JEM.

2. R&D

With respect to the operation system of the JEM, necessary R&D shall be implemented while communicating with the cooperating organizations concerned, and preparations necessary for the recruitment and screening of Japanese crew members shall be implemented through the cooperation of the administrative organs and specialists involved in space medicine.

B. Research

With respect to the space environment application experiment series, research involving technologies concerning space experiments shall be implemented, followed by research on space environment application equipment adaptable to an unmanned recovery system in orbit.

With regard to the space station involved in the space environment application experiment series and the manned space activities series, studies and basic ground experiments shall be implemented for relevant key technologies, manned support technologies, a space environment forecast system and a common orbit platform system and their key technologies, converging-type solar thermal power generation technology, space robot technology and artificial intelligence applied technology, followed by research involving space station applications in the field of technologies related to geostationary platform communications.

3. Miscellaneous

The development of the JEM and the R&D for its operation system shall be implemented smoothly, and the setup necessary for preparing a shift to JEM operation in the future shall be reinforced.

V. Development Program for the Field of Common Technologies for Artificial Satellites

A. Development Program

1. Operation

Engineering test satellite-V (ETS-V)

The engineering test satellite-V (ETS-V) "Kiku-5" launched in August 1987 shall be operated with a view to confirming the performance of the H-II test rocket (three stage), establishing key technologies for the geostationary three-axis satellite omnibus, accumulating the autonomous technologies necessary for the development of the next practical satellites and implementing mobile communications experiments for the aeromarine control of aircraft in the Pacific area and for communications, navigation assistance and the search and rescue of ships.

2. Development

Engineering test satellite-VI (ETS-VI)

The engineering test satellite-VI (ETS-VI) is intended to confirm the performance of the H-II test rocket, establish the large-size three-axis satellite omnibus technology necessary for the development of practical satellites in the 1990s and implement the technical development and experiments for the advanced satellite communications technologies involving fixed and mobile communications by satellites and intersatellite communications. The development of this satellite shall be continuously promoted, aiming at a launch into geostationary orbit in 1993.

B. Research

With respect to basic satellite technologies, research involving the improved reliability of electronic parts, etc., in preparation for the long life, high power and sophisticated functions of satellites, followed by research involving a space-use power supply system, a high-precision attitude control system, xenon ion engines, an active thermal control system, an antenna system, space-use bearings and future-type artificial satellites will be conducted. In addition, the standardization of satellite systems and parts materials shall be promoted.

VI. Development Program for the Space Transportation Field

1. Development Program

Development

a. M-system rockets

M-system rockets, using solid propellant for all stages, have been developed for use in launching scientific satellites. The development of these rockets shall be continuously promoted from the standpoints of a launchable scope at the Kagoshima Aerospace Observatory range and the optimum maintenance and development of all-stage solid rocket technology.

In other words, with respect to the M-3 S-II rocket for which the second and third stage motors of the M-3 S rocket have been improved and its first stage auxiliary rocket modified, the development shall be continuously promoted, aiming at launching the scientific satellite-14 (SOLAR-A) in 1991 and the scientific satellite-15 (ASTRO-D) in 1992.

In addition, with regard to the three-stage M-V rocket, each stage of which has been enlarged and whose airframe has been simplified in response to the demands of the scientific observation mission in the 1990s and beyond, the development of the rocket shall be implemented, aiming at launching the scientific satellite-16 (MUSES-B) in 1994.

b. H-I rocket

The H-I rocket has been developed as a three-stage rocket capable of launching a geostationary satellite weighing about 550 kg, using the first-stage liquid rocket of the N-II rocket for its first stage and adopting an engine using liquefied oxygen and hydrogen as a propellant for the second stage, a large fixed motor for the third stage and inertial guidance as the guidance method.

The development of the H-I rocket (three-stage)-3, H-1 rocket (three-stage)-6 and H-I rocket (two-stage)-5 shall be continuously promoted, aiming at launching the broadcasting satellite-3a (BS-3a) in 1990, broadcasting satellite-3b (BS-3b) in 1991 and the earth resources satellite-1 (ERS-1) in 1991, respectively.

c. H-II rocket

The development of the H-II rocket shall be continuously promoted as a two-stage rocket capable of launching a geostationary satellite weighing about 2 tons in response to the demand for launching large artificial satellites in the 1990s, employing an engine using liquid oxygen and hydrogen as a propellant for the first and second stages based on the developmental results of the same engines of the H-I rocket, and adopting two solid auxiliary rockets.

As part of this, the performance verification payload-mounted test rocket-1 for the H-II shall be launched in 1992 with a view to verifying the flight performance of liquid oxygen/hydrogen-driven engines for the first and second stages, the solid auxiliary rocket and the inertial guidance control system. Also, the development of test rocket-2 for the H-II shall be continuously promoted, aiming at launching the engineering test satellite-VI (ETS-VI) in 1993, as will that of test rocket-3 for the H-II, aiming at launching the SFU and GMS-5 simultaneously in 1993 as well.

In addition, with a view to providing flexibility to the H-II rocket launch program, a preliminary machine for the H-II rocket shall be developed. Furthermore, the development of the large fairing necessary for launching large artificial satellites shall be continuously promoted, as will a system for launching multiple satellites simultaneously.

2. Research

With respect to rocket application technology, research on orbit conversion technology, rendez-vous docking technology and recovery technology shall be implemented, followed by research on space planes, such an orbital transfer vehicle and an H-II rocket launch-type cruise recovery vehicle. Furthermore, studies shall be implemented that will involve liquid oxygen/hydrogen-driven engines, sophisticated rocket guidance control and rocket structure, and rocket-use parts materials.

VII. Reorganization of Facilities

A. Facilities Necessary for Developing Artificial Satellites and Rockets

1. The reorganization of facilities to be used for various tests involving the performance of observation-use equipment to be mounted on artificial satellites and the satellites themselves shall be implemented.

2. The reorganization of the test facilities necessary for the development of the H-II rocket and for the improvement of the reliability of the M-3 S-II rocket, as well as for the development of the M-V rocket, shall be implemented.

3. With respect to the reorganization by NASDA [National Space Development Agency of Japan] of the test facilities and equipment necessary for development, large facilities commonly used for large equipment and various instruments shall be centralized, their management and data processing conducted effectively, and their shared use by the R&D organizations concerned considered.

4. The reorganization of remote sensing information receiving and processing facilities in Japan shall be implemented so as to contribute to the R&D for earth observation systems using artificial satellites.

B. Launch Facilities for Artificial Satellites and Rockets

The reorganization of Tanegashima Space Center's facilities and equipment shall be implemented for the range control and radar telemeter systems as well as for the H-II rocket launch complex. In addition, the reorganization of existing facilities at Kagoshima Aerospace Observatory, Institute of Space and Astronautical Science, shall be implemented.

C. Facilities Required for Satellite Tracking, etc.

The reorganization of tracking facilities shall be implemented, aiming at tracking broadcasting satellites (BS-3a and BS-3b) and scientific satellites, followed by that of the space operation data system (SODS) to cope with the simultaneous launching of multiple satellites by the H-II rocket. In addition, the reorganization of a facility at the Tsukuba Space Center which will serve as the core of a tracking network and will conduct activities deemed appropriate for individual implementation from among those involving satellite operation and management and data acquisition shall be implemented. Furthermore, the reorganization of facilities necessary for the acquisition and control of scientific satellite data shall be implemented.

4. Other facilities

The reorganization of the ramjet engine test facilities necessary for the R&D of propelling system technology involving space planes shall be implemented.

VIII. Other Measures

A. Reinforcement of R&D Ability

National test and research institutes shall be reinforced and constructed, their research promoted and, to organically combine these studies and the developments conducted by NASDA, their R&D activities shall be reinforced and improved.

B. Promotion of International Cooperation

International cooperation with advanced and developing countries shall be promoted in parallel with the development programs of individual fields, such as science, observation, space experiments and space stations, and international cooperation in the space development field shall be reinforced and promoted by preparing for participation in the space field-related activities of the SSLG, the Science & Technology Joint Committee with France, Germany, Canada and Australia, the ESA Administrators Conference, the United Nations Conference on Exploration and Peaceful Uses of Outer Space and the International Space Year (ISY), by extending invitations to those concerned with space development overseas, and by reorganizing databases for information exchange with foreign countries, including the United States.

C. Measures Concerning Space-Related Agreements

Necessary measures shall be taken for the smooth implementation of space-related agreements, such as an "Agreement on international responsibilities involving damage caused by space objects."

D. Reinforcement of Activities for Dissemination and Enlightenment

Comprehensive activities for dissemination and enlightenment shall be reinforced for all space developments for the dissemination of the results of Japanese space development activities, the promotion of their usage and the public's understanding and cooperation with respect to space development.

E. Education of Space Engineers

In order to improve the qualifications of space-related engineers, the institute staff concerned shall be detached to universities, research institutes and administrative organs.

F. Reorganization of the Space Development Promotion Base

For the smooth launching of Japanese artificial satellites, the furtherance of fishery protection activities in the periphery of Tanegashima Island shall be implemented.

IX. Budget

The space-related budget necessary for promoting the development of artificial satellites and rockets, reorganizing facilities and promoting special studies is shown in the following tables.

FY-90 Space-Related Government Budget Bill Master Table

	FY-89 Budget			FY-90 Budget		
	Space-development Related	Space Related[2]	Total	Space-development Related	Space Related[2]	Total
Science and Technology Agency	84,412[1]		84,412[1]	87,393[1]		87,393[1]
	109,062		109,062	119,416		119,416
National Police Agency		118	118		110	110
Environment Agency	51		51	118		118
Ministry of Education	11,323[1]		11,323[1]	13,958[1]		13,958[1]
	12,847	7,938	20,785	13,781	4,241	18,022
MITI	14,563		14,563	6,708[1]		6,708[1]
				14,927	10	14,937
Ministry of Transport	1,213[1]		1,213[1]	11,268[1]		11,268[1]
	3,601	2,673	6,274	3,346	2,744	6,090
Ministry of Posts and Telecommunications	44[1]		44[1]	527	2,820	3,347
	564	3,455	4,019			

FY-90 Space-Related Government Budget Bill Master Table (Continued)

	FY-89 Budget			FY-90 Budget		
	Space-development Related	Space Related[2]	Total	Space-development Related	Space Related[2]	Total
Ministry of Construction		2	2		2	2
Ministry of Home Affairs		120	120		119	119
Grand Total	96,993[1]		96,993[1]	119,327[1]		119,327[1]
	140,688	14,306	154,994	152,114	10,046	162,160

Unit: Millions of yen
[1] Contract authorization limit

[2]Space-related expenditures (except for the estimate by the Space Developmental Committee) are also presented for reference.
Note 1: Sums rounded so as to be presented on the basis of a unit of 1 million yen with respect to each item, therefore, the grand total of each item is not necessarily in accordance with its actual total.
Note 2: FY-89 budget is the initial budget.

FY-90 Space Development Related Government Budget

Ministry and Agency	Authority in Charge	Item	FY-89 Budget	FY-90 Government Budget
Science and Technology Agency	Research and Development Bureau	Expenditure necessary for the Space Development Committee	62	64
		Expenditure necessary for research on marine remote survey technology		82[1]
		Expenditure necessary for general administration	31	36
		Expenditure necessary for improved quality of scientific engineers	41	41
		Expenditure necessary for fishery protection measures in the periphery of Tanegashima Island	412	412
		Subtotal	547	553
	Director General's Secretariat	Expenditure necessary for general administration	4	4
	National Aerospace Laboratory	Expenditure necessary for the National Aerospace Laboratory	792[2]	641[2]
			1,754	2,566
	National Space Development Agency of Japan	Expenditure necessary for financing and furthernace of National Space Development Agency of Japan	83,620[2]	86,752[2]
			106,757	116,293
			Government capital subscription	Government capital subscription
			83,620[2]	86,752[2]
			97,287	106,370
			Government subsidy	Government subsidy
			9,470	9,923
	Japan Atomic Energy Research Institute	Research expenditure for radiation applications	Radiation high-tech research	Radiation high-tech research
			3,715[2]	617[2]
			4,888[1]	4,500[1]
	Total		84,412[2]	87,393[2]
			109,062	119,416

FY-90 Space Development Related Government Budget (Continued)

Ministry and Agency	Authority in Charge	Item	FY-89 Budget	FY-90 Government Budget
Environment Agency	Planning and Coordination Bureau	Research expenditure for prevention of public pollution	51	118
	Air Quality Bureau			
	Total		51	118
Ministry of Education	Institute of Space and Astronomical Science	Expenditure necessary for special activities, etc.	11,323[2]	13,958[2]
			12,847	13,781
	Total		11,323[2]	13,958[2]
			12,847	13,781
MITI	Machinery and Information Industries Bureau	Development of unmanned space experimental system, etc.		6,708[2]
			4,487	5,271
		R&D for resources remote survey technology	8,890	8,615
		Subtotal		6,708[2]
			13,377	13,885
	Agency of Natural Resources and Energy	Wide area environmental influence monitoring investigation	305	960
	Agency of Industrial Science and Technology	R&D for resources remote survey technology	806	0
		Expenditure necessary for special studies at research institutes and laboratories	75	82
		Subtotal	881	82
	Total			6,708[2]
			14,563	14,927
Ministry of Transport	Transport Policy Bureau	Expenditure necessary for development of transport technology	19[2]	200[2]
			39	58
	Electronic Navigation Research Institute	Expenditure necessary for Electronic Navigation Research Institute	90	26
	Meteorological Agency	Expenditure necessary for geostationary meteorological satellite management	1,194[2]	11,068[2]
			3,472	3,262
	Total		1,213[2]	11,268[2]
			3,601	3,346
Ministry of Posts and Telecommunications	Communications Policy Bureau	Expenditure necessary for telecommunications administration	7	14
	National Communications Research Institute	Expenditure necessary for R&D for space communications technology	44[2]	
			557	512
	Total		44[2]	
			564	527
Grand total			96,993[2]	119,327[2]
			140,688	152,114

Unit: Millions of yen
[1]or some portion thereof
[2]Contract authorization limit

FY-90 Space-Related Government Budget

Ministry and Agency	Authority in Charge	Item	FY-89 Budget	FY-90 Government Budget
National Police Agency	Communications Bureau	Expenditure necessary for police communications	118	110
	Total		118	110
Ministry of Education	Institute of Space and Astronomical Science	Expenditure necessary for special activities, etc.	7,938	4,241
	Total		7,938	4,241
MITI	Machinery and Information Industries Bureau	Investigation of trends of rocket launch service industry	0	10
	Total		0	10
Ministry of Transport	Electronic Navigation Research Institute	Expenditure necessary for air route readjustment management	0	177
	Maritime Safety Agency	Expenditure necessary for operating hydrographic management	137	140
	Meteorological Agency	Expenditure necessary for geostationary meteorological satellite management	2,260	2,140
		Expenditure necessary for general observation management	66	66
		Expenditure necessary for meteorological fluctuation management	210	220
		Subtotal	2,536	2,426
	Total		2,673	2,744
Ministry of Posts and Telecommunications	Minister's Secretariat	Expenditure necessary for implementing satellite communications	1,157	1,055
	Communication Policy Bureau	Expenditure necessary for telecommunications administration	3	6
		Expenditure necessary for financing Communications/Broadcasting Satellite Organization	2,000	1,500
		Subtotal	2,003	1,506
	National Communications Research Institute	Expenditure necessary for R&D for space communications technology	295	260
	Total		3,455	2,820
Ministry of Construction	Geographical Survey Institute	Expenditure necessary for geodetic datum point measurement	2	2
	Total		2	2
Ministry of Home Affair	Fire Defense Agency	Expenditure necessary for maintenance and management of radio communications facilities	120	119
	Total		120	119
Grand Total			14,306	10,046

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ISHII (ISAS)

Government, Industry Promote Sugar-Chain Engineering R&D

91FE0089A Tokyo TSUSANHO KOHO in Japanese 26 Sep 90 pp 3-5

[Text] A conference to exchange the ideas between governmental agencies and industries involved in bioindustry.

September, Biochemical Industry Division, Basic Industries Bureau

As described below, a conference was held to exchange the ideas between governmental agencies involved in bioindustry—Science & Technology Agency [STA], Ministry of Health & Welfare [MHW], Ministry of Agriculture, Forestry & Fisheries [MAFF] and Ministry of International Trade & Industry [MITT], and those representing the industry—Federation of Economic Organizations [FEO], Bioindustry Association [JBA], and Biotechnology Research & Development Association [BRDA].

In the area of biotechnology, there are many cases of traversing projects among ministries. The purpose of the meeting was to discuss these projects without reservations among involved ministries, agencies and industry to assist in healthy development of bioindustry in Japan in the future.

At this time, the topic was "Sugar-Chain Engineering" research that is to be promoted as a inter-ministerially cooperative project at the time of the budget requests by the three ministries and one agency for the 1991 fiscal year [FY].

MINUTES		
Date: 13 September 1990, Thursday		
Place: Afuhi Meeting Hall		
Attendants		
Involved Governmental Agencies		
STA	Koysusuke Kuroda	Councilor of the Secretariat, (assigned to S&T Policies Bureau)
	Mahito Chichiya	Head, Life Science Division, R&D Bureau
	Hiroshi Shimizu	Coordinator, Cancer Research, R&D Bureau
	MHW	Kazutaka Ichikawa Councilor, Ministerial Secretariat (assigned to Pharmaceutical Industries Bureau)
	Motonari Fujii	Leader, Leading Edge Medical Technology Promotion Group, Pharmaceutical Industries Bureau
MAFF	Keiji Kainuma	Manager of Research Affairs, AFF Technologies Conference Business Bureau
	Katsuaki Ui	Head, Biotechnology Division, AFF Technologies Conference Business Bureau
MITI	Masahisa Naido	Chief, Basic Industries Bureau
	Masaru Masuda	Head, Biochemical Industries Division, Basic Industries Bureau
Industry		
	Takeshi Tsuchigata	Chairman, JBA; Chairman, BRDA (Chairman, Sumitomo Chemical Co.)
	Seiji Suzuki	Chairman, Life Science Committee, FEO (Chairman, Mitsubishi Chemical Industries)
	Susumu Minakawa	Head, Planning Department, Life Science Committee, FEO (Executive Director, Mitsubishi Chemical Industries)
	Akira Furuya	Head, Recombinant DNA Technology Department, Life Science Committee, FEO (Executive Director, Kyowa Fermentation Industries)
	Yoshihiko Nishizawa	Chairman, Administration Committee, JBA (Executive Director, Sumitomo Chemical Co.)
	Yasu Yamamoto	Head, Industry and Society Department, JBA (Vice-President, Kirin Beer Co.)
	Masayoshi Mishima	Head, Technologies Department, JBA (Executive Director, Mitsui Toatsu Chemicals, Inc.)
	Ryuichiro Togawa	Head, International Department, JBA (Director, Ajinomoto Co., Inc.)
	Fujio Ishikawa	Managing Director, JBA
	Atsuo Murai	Managing Director, BRDA

Consolidated Promotion of Inter-ministerially Cooperated Research Project on "Sugar-chain Engineering"

September, Liaison Conference on Sugar-Chain Engineering

1. Basic Considerations

(1) The sugar chains are the basic units of sugars. They not only are sources of biological energy and nutrients, but, as research on life phenomena at the molecular level is being advanced in recent years, it is becoming clear that they also play important roles in the body's overall coordinations of functions such as formation of body's cellular structures; intercellular communications; inception, differentiation and reproduction of the life; etc.; and maintenance of functions of immune and nerve systems.

(2) As the knowledge in the intimate relationships between sugar chains, and biological activities and maintenance of the life is being rapidly accumulated, senescence of body's cells and mechanism of carcinogenesis are being elucidated in detail. At the same time, the expectations are being heightened in development of functional raw materials by mass productions of sugar-chains that possess new functions and establishment of new technologies to improve the forms and qualities by introducing abilities to produce specific sugar-chains. The ripple effects will encompass wide ranges of medicines and therapeutics, pharmaceuticals as well as chemical industries, agriculture, forestry and fishery industries, and food industries.

(3) Therefore, using the content of the response (26 July 1990) to the Inquest No. 14 by Aeronautic and Electronic Technologies Council (Chairman, Kuniomi Umezawa), "On the policy of promotion of comprehensive R&Din laying the foundation for sugar-chain engineering" as a step stone, the leading research institutions will be assembled to cooperatively develop the basic, leading research on "Sugar-Chain Engineering" that is expected to become the core technology of the next-generation biotechnology along with genetic engineering and protein engineering under close cooperations between involved ministries and agencies, and among industry, government and universities. The effort will be eventually expanded to the basic technologies of various areas of the industry.

2. The Outlines of The Entire "Sugar-Chain" Engineering Project

(1) Ministries and Agencies Involved in the Planning

STA, MHW, MAFF, MITI

(2) Institutions Involved in the Planning

Universities, national research institutes, private research institutes

(3) Research Period

FY 1991 - 2000 (10 years)

(4) Research Budget

The budget for the entire research period: Several multiples of 10 billion yens.

3. The Concrete Promotion Plan

(1) Promotion of "Sugar-Chain" Research by Inter-Ministerial Cooperation

In order to efficiently promote "Sugar-Chain Engineering" research that is to be carried out cooperatively between involved ministries and agencies, and among industry, universities and government, Conferences on Sugar-Chain Engineering Research to be attended by the involved ministries, agencies and those research institutions taking parts in the planning will be held. Workshops on sugar-chain engineering will also be held in order to promote further the research by boosting exchanges and interchanges of informations among researchers in the many leading fields here and abroad. (STA)

(2) Elucidation of the Functions of Sugar-Chains by Promoting The Basic, Leading Research.

For the purpose of elucidating the functions of sugar-chains in the body, (a) research on sugar-chains in cellular interactions, (b) research on genes involved in the syntheses and decompositions of sugar-chains, and (c) development of biological methods of analysis of micro quantities of sugar-chains in the body will be carried out as parts of "Body Homeostasis" system research being conducted by the Frontier Research Group at Institute of Physical and Chemical Research [IPCR]. (STA)

(3) Laying The Technological Foundation of Various Industries That Are Based on Applications of Sugar-Chains

(a) Research on the development of the technologies of productions and applications of complex sugars.

The research on the development of the technologies of productions and applications of complex sugars will be conducted in order to firmly establish the technologies of efficient productions and applications of functional sugars that are derived from the development of technologies of chemical and biological syntheses of complex sugars, and sugar-chain remodeling technology. (MITI)

(b) Comprehensive research on the development of highly functional raw materials derived from structural transformations of sugars.

"Comprehensive research on the development of highly functional raw materials derived from structural transformations of sugars" will be promoted. Its aims are cultivations of new plants and animals in the realm of AFF that possess outstanding characteristics of high production of functional sugar substances, etc., and

development of highly functional, new AFF resources that derived from affixing newly created sugars. (MAFF)

(c) Research on the life science aspect of sugar-chain engineering.

Development of diagnostic technologies derived from elucidation of functions of sugar-chains; medicines such as new, superior types of vaccines derived from applications of sugar-chains; site specific drug delivery systems derived from affixing sugar-chains to the drugs; etc. will be promoted as parts of the research on the life science aspect of sugar-chain engineering. At the moment these will be funded by the Special Account of Industry Investment coming out of the Fund for Advancing Research on and Compensation for Victims of Side-Effects of Medicines. (MHW)

(4) Others.

Developments of common, basic technologies, such as sugar-chain isolation, purification, and structural analysis, for elucidation of the mechanism of sugar-chain synthesis or mechanism of expression of the function need to be carried out consolidatedly by assembling the research capabilities scattered over individual ministries, agencies and research institutions. The promotion of this consolidated research using the funding from S & T Promotion and Coordination Fund will be evaluated.

4. The Budget Requests for FY 1991 by The Involved Ministries and Agencies.

(1) STA

Promotion of research on sugar-chain engineering—5 million yens

IPCR "Body Homeostasis" system research by Frontier Research Group. Research on sugar-chain in cellular interactions and 2 other projects (FY 1991 - 2000)—188 million yens

(2) MAFF

Leading biotechnology R&D. "Comprehensive research on developing highly functional raw materials by transformations of sugar-chain structures"—(FY 1991 - 2000)—112 million yens

(3) MITI

Basic technologies of the next generation industries R&D"Technologies of productions and applications of complex sugars"—(FY 1991 - 2000)—50 million yens

(4) MHW

Special Account of Industrial Investment Sugar-chain engineering related enterprises funded by the Fund for Advancing Research on and Compensation for Victims of Side Effects of Medicines Included in 3.2 billion yens

On Establishing Conferenence on Sugar-chain Engineering Research (Tentative Name)

12 September Liaison Conference on Sugar-Chain Engineering Research

1. Details

In September, 1989, the involved divisions of STA, MHW, MAFF and MITI in sugar-chain engineering agreed to cooperate in coordinated promotion of the project. In April, 1990, the liaison conference was established by the involved divisions of three ministries and one agency, and several meetings have been held since then for the purpose of liaison and coordination.

- First Liaison Conference (10 April, 1990)

The meeting was held by the involved divisions of STA, MHW, MAFF and MITI to consult on the research plan for each field of sugar- chain engineering. "Liaison Conference on Sugar-Chain Engineering Research" was established for the purpose of promoting as a common project henceforth.

- Second Liaison Conference (26 April, 1990)

The ideas on the planned response to No. 14 Inquest by Aeronautic and Electronic Technologies Council, "On the policy of promotion of comprehensive R&Dfor laying the foundation for sugar-chain engineering", were exchanged. Overall design for the sugar-chain engineering research project was evaluated.

- Third Liaison Conference (11 May, 1990)

The assignments for individual ministries in the overall design of sugar-chain engineering research project were evaluated.

- Fourth Liaison Conference (24 May, 1990)

The ideas on the progress status of the sugar-chain engineering project and the budget requests of individual ministries were exchanged.

- Fifth Liaison Conference (29 June, 1990)

The opinions on the sugar-chain engineering research projects of individual ministries and the forms of the system for cooperation and coordination were exchanged.

- Sixth Liaison Conference (16 July, 1990)

The ideas on the overall design of the sugar-chain engineering projects of individual ministries were exchanged.

- Seventh Liaison Conference (27 July , 1990)

The overall plan of the sugar-chain engineering project and the establishment of Conference on Sugar-Chain Engineering Research (tentative name) were evaluated.

- Eighth Liaison Conference (14 August, 1990)

The budgets of individual ministries for the research project were introduced and the overall plan of the project was further evaluated.

- Ninth Liaison Conference (21 August, 1990)

The basic agreement on the establishment of Conference on Sugar- Chain Engineering Research (tentative name) from individual ministries was obtained.

- Tenth Liaison Conference (12 September, 1990)

The ideas on the comprehensive promotion of inter-ministerially cooperated "sugar-chain" engineering research project were exchanged, and the basic agreement by individual ministries was obtained.

Henceforth, each ministry plans to communicate and coordinate at the Liaison Conference on Sugar-Chain Engineering Research to endeavor to forge a system of consolidated promotion as a whole.

2. On The Establishment of Conference on Sugar-Chain Engineering Research (tentative name)

As another step toward realization of cooperation and coordination in sugar-chain engineering research and to facilitate effective promotion and development of sugar-chain engineering research, "Conference on Sugar-Chain Engineering Research (tentative name)" will be established in an appropriate time based on what have been discussed in Liaison Conferences on Sugar-Chain Engineering Research.

(i) Purpose The purpose of Conference on Sugar-Chain Engineering Research is to facilitate a smooth execution of the research project through consultation and coordination in formulation of the overall research plan, information exchanges, research exchanges (holding workshops, common meetings for announcing research results, common symposia, etc.), etc. that are related to the sugar-chain engineering research project of the 3 ministries and 1 agency.

(ii) Organization

[Translator's Note: Please see the attached chart]

Technologies for Productions and Applications of Complex Sugars

[Next-Generation Industries and Technologies Planning Office]

1. The Substance of R&D

The body is consisted of four basic constituents, nucleic acids, proteins, lipids and sugars. Among these, sugars are becoming known in recent years to perform many beneficial functions which can not be performed by the body's nucleic acids, proteins and lipids alone, and have raised the expectations of applications in industry. For instances, a sugar-chain affixed to an enzyme can elevate the enzymatic function of promoting a reaction to produce a chemical, or a sugar-chain can recognize a specific substance or cells to act on them selectively to perform efficient maintenance of the body.

In this project, elucidation of functions of complex sugars will be advanced, and upon this basis, establishment of technologies for synthesis and application of industrially useful complex sugars will be attempted.

2. The Period of R&D

FY 1991 - 2000

3. Consigned Agencies

- Undecided on the Enterprise.

- Institute of Chemical Technologies, Fermentation Research Institute, and Research Institute for Polymers and Textiles.

4. R&D in FY 1991

(1) Estimated Requested Budget, 50 million yens.

(2) The main points of R&D

Elucidation of functions of complex sugars and, at the same time, development of technologies for syntheses of useful complex sugars.

- Conference on Sugar-Chain Engineering Research (Tentative Name)
  - S&T Inquest Committee
  - Liaison Conference of Involved Ministries
    - STA: Life Science Division, R&D Bureau
    - MHW: Leading Medical Technologies Promotion Office, Economic Affair Division, Pharmaceutical Affair Bureau
    - MAFF: Biotechnology Division and R&D Division, AFF Technology Conference Affair Bureau
    - MITI: Next-Generation Industries Planning Office, Agency of Industrial Science and Technology, Biochemical Industries Division, Basic Industries Bureau
  - Liaison Conference of Research Executing Institutions
    - STA: IPCR
    - MHW: Undecided
    - MAFF: Undecided
    - MITI: Private Research Institutes, Fermentation Research Institute, Research Institute for Chemical Technologies, Research Institute for Polymers and Textiles

Fujitsu Announces New Parallel-Processing Supercomputer Models

91P60035 Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 39, 10 Oct 90 p 29

[Unsigned article: "Fujitsu Announces New Large-Scale-Job Parallel-Processing Supercomputer Models"]

[Summary] Fujitsu recently announced two new large-scale-job parallel-processing supercomputer models in its VP2000 supercomputer series: the VP2400/40 and the VP2200/40, and simultaneously announced the new F6490 parallel-access high-data-transfer-rate disk with its high-speed optical channel HIPPI (short for High-Performance Parallel Interface), which has a transmission rate of 100MB/second. The goal of these products has been to realize high data-transmission efficiency and to meet the high data-processing demands of large-scale scientific-calculation jobs. Fujitsu also estimated that the F8460 will be made available for use with the M series of general-purpose computers within 1 or 2 years.

The model VP2400/40, formed from two model 20's in the earlier VP2000 series (each model 20 consisting of one vector processor and two scalar processors), has vector and scalar processor cycles of 3.2 nanoseconds (ns) and 6.4 ns, respectively—reduced from the 4 ns and 8 ns, respectively, of the older models. Processing performance is 2.5 times that of the 2400/20 and has reached 5 GFLOPS [billion floating-point operations per second], equivalent to the highest performance of the VP2600 (which has one vector processor and two scalar processors, with the same processor specifications; first units shipped from plant in June this year). In addition, Fujitsu simultaneously announced new system-memory control units that employ GaAs LSI chips; this is the first time such components have been used for mainframes.

The F6490 is an "array disk," which permits parallel loading of data onto several disk modules. Storage Technology, a U.S. firm, is currently stepping up its development of this type of product, and this is the first commercialization of this product in the world. The disk modules are identical to the disk elements of the large-type F6427H disk (capacity of 1.89GB) used with general-purpose computers; 10 (eight for data, one for parity checking, and one spare) are arranged together and the whole assembly has a control motor with a "rotating

synchronous structure." Data transfer rate is 36MB/second, eight times that of the F6427; access speed is the same as that of the F6427.

The HIPPI channel uses the high-speed interface UltraNet developed by the U.S. firm Ultra Network Technology Company. Its maximum data transfer rate is 1GB/second, compared to the maximum value of 4.5MB/second for the MBC [sic] (Block Multiplexer Channel) used in earlier VP-series models.

Fuzzy Control Method Applications Described

91FE0029A Tokyo NIHON FAZI GAKKAI in Japanese 9 Jul 90 pp 51-52

[Excerpt from an article by Shuta Murakami and Mikita Maeda of Kyushu Engineering University: "The Design of Fuzzy Control Devices and Their Applications"]

[Excerpt] **Applications of Fuzzy Control**

Below is a brief introduction to areas where the fuzzy control method has already been applied and areas where it is being applied.

Automated Train Operation (ATO) by the Precognizant Fuzzy Control Method

This method was developed by Hitachi Ltd. and is being used in the automated operational control of subway trains in Sendai. The notable features of this control method, used as the criteria for evaluating the control results, are its comfortable ride, safety, amount of electricity consumed, and precision of its braking. An independent idea was introduced regarding the method for constructing the controls and the rules for their evaluation. The controls and their evaluation rules are composed of the following.

Ri: If (u is Ci $\rightarrow$ x is Ai and y is Bi) then u is Ci, (i=1,2...,n)

This is explained to mean "If, when u is Ci is implemented, the values of the evaluation indices x, y are Ai and Bi respectively, the control rule Ri can be selected, and Ci can be produced as the control instruction." In other words, when an operational quantity of Ci is used, the value of the evaluation indices x, y can be predicted from the knowledge of the control subject, and this means that if the uniformity of the premise part of rule Ri (the fuzzy compatibility degree) is greater than those of other rules, then along with selecting this rule, Ci will be produced as the operational quantity.

The results of operational tests of this control method are said to have determined that the comfortability of the ride is good and that 10 percent more energy is saved than by the PID control device.

Use of Fuzzy Logic in Water Purification Plant Drug Injection Controls

This is an example whose application is being carried out by Fuji Electric Co. Ltd. and Tokyo Engineering University. The subject water purification plants are the Toyoseki Water Purification Plant in Akita and the Sagamibara Water Purification Plant in Kanagawa Prefecture.

The notable features of this method are that it makes use of a method that includes the portion that could not be handled by the statistical medicine injection rate methods used in the past by assuming the revised amount by means of fuzzy inference, and that it makes use of a method seeking the target value of the medicine injection control device by means of fuzzy inference.

The Rolling Load Distribution Control of a Finishing Rolling Machine

This method is one which control the amount of the load on a variety of rolling machines used to roll materials to a desired sheet thickness. The control rule used here is one in which the conclusion is of a non-fuzzy functional form (example: if... then u=f(..)). This method constructs the conditions of the rule by means of the knowledge of experts, assumes the functional form of the conclusion is assumed by means of statistical processing from real operational data (expert control motion data), and designs the control device. At present, this control method is operating at Nippon Steel's Nagoya Steel Manufacturing Plant.

Fuzzy Controls of a Tunnel Excavation Device

This method was developed by Tokyo Electric Power and Kumagai Gumi Co. Ltd., and uses fuzzy logic for the purpose of achieving two control objectives in tunnel excavation.

The first is a method for controlling the pressure within the soil intake chamber by adjusting the speed of the excavation and the speed of removal of the excavated soil, for the purpose of maintaining a standard figure of the amount of the excavated soil. The other is a method for controlling the direction of the excavation by looking in the jack selection rules and their fuzzy logic for the pattern of the shield jack to be used, along with such things as the disparity between the excavation direction and the project line and the meandering volume of soil.

Others

In addition to those introduced above, there are the uniform sintering controls of Kawasaki Steel Corporation and the temperature controls of hot water faucets of Matsushita Electric Industrial. Fuzzy controls are also being used in Mitsubishi Heavy Industry's refuse incinerator combustion controls and the automated dredging controls of its pump dredging ships, as well as the controls of autonomous mobile robots built by Tokyo Agricultural and Industrial University and at the authors' research offices. Moreover, this is in the initial

stage of research, but there is also the control of the speed and steering of automobiles operated by the authors.

In this way, fuzzy controls are being used everywhere, and applications are increasing each year.

6. Conclusion

There is the sense that fuzzy controls have finally reached a point of status after 11 years, and a variety of research results have confirmed that the application of fuzzy controls to control systems where satisfactory results have not been obtained up to now improved the control results. The future is hopeful for the design of control devices, the establishment of tuning systems, and the rounding off of basic research such as learning functions and safety discrimination.

Moreover, consideration of fuzzy inference and the time for data processing in the use of fuzzy controls is important. For that purpose, the use of Yamakawa's and Togai's fuzzy computers and Arikawa's and Shoda's fuzzy logic memories are being considered as high-speed hardware computer processors, and the use of simple inference logic in software is also anticipated. Furthermore, systems are being considered in which the most appropriate control devices are being prepared by the control response pattern, and according to the response pattern at that time, these control devices will be switched by fuzzy switching (not on-off).

Development of Massively Parallel Processors Stepped Up

91P60044 Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 41, 24 Oct 90 p 57

[Unsigned article: "Japan Steps Up Development of Super Parallel Processors"]

[Summary] Several large Japanese electromechanical manufacturers are stepping up development of super-level parallel processing computers, known as "massively parallel processors" (MPPs). The "ADENA," jointly developed by Matsushita Electric Industry Co. and Kyoto University, is to be commercialized by the end of this year [1990]. Fujitsu, which has already developed its "CAP256" special-purpose image processing computer, will put its improved model, the "CAP II," on the market in Spring 1991. NEC and the Science and Technology Agency's National Aerospace Laboratory are now cooperating on improvements to NEC's "Cenju." The Anritsu Company's "QCDPAX," developed under the guidance of Tsukuba University Professor Hoshino, will be applied to workstation development. Toshiba Corporation, NTT and other firms are also stepping up the pace of MPP development.

The MPP with the currently highest performance is the "Ncube," manufactured by the U.S. firm of the same name; its peak speed is 27GFLOPS [billion floating-point operations per second]. Among supercomputers, the highest performer is NEC's "SX3" at 22GFLOPS. At least in Catalogue performance, therefore, the MPPs outperform the supercomputers. The CAP II, the QCDPAX and other models are rated at over 10GFLOPS. Engineers at Matsushita are spending the next two years in a project to transform the ADENA; they will connect four improved "OHM," MPPs together to reach 100GFLOPS or more.

MITI plans to concentrate on development of MPPs as an administrative project beginning in 1992 and is currently working out the details of specific guidelines and orientations. While the computer industry is somewhat anxious, the Japanese government is adopting a policy of cooperation among industry, government, and academia for development of the MPPs. The intense competition involved will touch upon the interests of the United States and can lead to a new round of technological friction betwen Japan and the U.S.

Table: Japan's Massively Parallel Processors (GFLOPS/unit)

Developer	Model	Peak Performance	Max. # of Processors
Matsushita Electric Industry Co.	ADENA256	2.6	256
	OHM256	25.0	256
Fujitsu	CAP256	0.016	256
	CAP II	12.5	1024
	MAPLE	—	16,000
Anritsu	QCDPAX	12.5	432
NEC	Cenju	0.5	256
NTT	R256	0.5	256
Toshiba	Prodigy	—	512

Long Term Forecast for Electric Power Supply and Demand

91FE0090A Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 14 Jun 90 p 6

[Text] According to an interim report, on 13 June the Supply and Demand Subcommittee of the Electric Industry Council completed its long range forecast for electric power supply and demand through the year 2010. On the electric power supply side nuclear power generation is already playing a central role as a petroleum substitute and by the year 2010 capacity will reach 72 million kW, a 27 percent share. It will occupy an important position as an important energy source with a supply total of 473 billion kWh, a 43 percent share. This report will present the details concerning the forecast.

The circumstances surrounding present-day electric power are represented by the strengthening of the anti-nuclear movement and coping with world environmental problems and so the restricting factors on the electric power supply side have come to be revealed. On the other hand electric power demand in Japan is expected to reflect the diversification of the public standard of living and the public drive for amenities and fairly large increases are expected to continue into the future as well, driven by residential demand. Consequently, if events evolve in this way, in the future there will certainly be apprehension concerning the extreme tightness of electric power supply and demand. In particular the fragility of energy supply in Japan which has few natural resources will serve to intensify these fears. In addition the existence of regional differences in demand for electric power, along with regional differences in power source siting has given rise to the possibility of regional differences in how tight supply and demand are.

In other words in the future we will be encountering situations which we have never experienced before and it will be necessary to change our old ways of thinking in regard to how to cope with them. To this end we will of course have to expand the supply side beyond what it is at present and make every effort to develop power sources. In addition we will not only have to cope in the traditional way with quantifying expected demand and then working at assuring that we have the supply power to meet it, but in coping with the demand side as well we will have to expand the areas in which measures are taken. Electricity is priceless secondary energy and it is thought that making progress on its completely efficient use will require an effort to limit demand to as rational a range as possible.

The Development of a Supply-Side Accommodation

1. Building a Suitable Power Source Structure

In building a suitable power source structure, we will have to make our major goal the "assurance of strong supply capacity," to pay adequate attention to "reducing supply costs" and "improving harmony within the corporate economic environment," and to maintain an adequate balance without relying too much on a single type of power source.

2. Promoting the Development of Atomic Energy

Nuclear power generation has stable fuel supply and price and outstanding economic and environmental characteristics and so it will be necessary for Japan to promote its utilization to the upmost as valuable quasi-domestically produced energy.

Nevertheless, when one takes into account the fact that there are limits to our flexibility in dealing with increases in demand in terms of power source development and operational planning for nuclear power generation, its proportion within the power source structure can be considered to be at suitable levels.

In addition while the superiority of nuclear power generation has been proven, the public consciousness lacks confidence in atomic energy, feels that information is inadequate, and has doubts and uneasy feelings about its safety. Because of this the idea has come into play that we should adopt a cautious attitude about development and so it can be said that there are problems in terms of social acceptance. For this reason we must gain broad-based public understanding and confidence. In order to develop reliably the necessary scale of nuclear power generation, the establishment of the nuclear fuel cycle will be essential to atomic energy development, especially for back-end policies. Because of this, in the future it will be necessary to gain broad-based public understanding and cooperation and for both the government and the people to work positively. In regard to measures for the processing and treatment of radioactive wastes, it will be necessary to work actively toward policies which are both integrated and all-encompassing. At the same time in regard to policies regarding the processing and disposal of high level radioactive wastes, it will be especially important to quickly present an action program and to work toward implementing it.

On the other hand as we work toward constructive public judgements and discussions regarding atomic energy development, it will be important for individuals in the government and the electric power industry to stress clear assurances for both the disclosure of appropriate atomic energy information and its active dissemination and at the same time to expand more effective PA measures.

3. Coping with World Environmental Problems

Although the scientific mechanisms behind greenhouse effect problems are not yet understood, the electric power industry must both adequately consider the assurance of stable supply and devote itself to a possibly limited effort to control the generation of CO_2. To this end it will be necessary to work at controlling the amount of CO_2 emissions by improving generation efficiencies, to pay adequate attention to major problems in putting together the make-up of power sources and to work hard at increasing the weight given to power sources which generate little CO_2.

The Development of a Demand-Side Accommodation

Promoting the Understanding of Demand in Regard to Power Supply and Demand Problems

As stated previously, future power demand is expected to expand considerably based on residential demand. On the demand side as demand for electricity increases because of the drive for amenities, power supplies will be restricted because of environmental protection and the anti-nuclear power movement. We will have to recognize that the fact that these are mutually contradictory demands.

When one looks at the new power supply and demand situations which we will attempt to control in the future, it will not be an era in which the demand side will be able to use electric power without limits and it is thought that an era will soon come in which the demand side will have to pay adequate attention to the balance of power supply and demand. On the basis of a recognition of this fact we will have to sincerely avoid these situations as they arise in the future, to appeal to the public regarding situations where the quantity and quality of demand is in conflict with limitations in supply relative to the acceptance of companies, and to promote a consciousness and recognition of these facts.

Expected Demand For Electric Power

Category	1988	2000	2010	Expansion	Expansion
	(actual)			88/00(%)	00/10(%)
Residential	2,812	4,520	5,750	4.0	2.4
	(41.8)	(48.7)	(53.3)		
Industrial	3,911	4,750	5,050	1.6	0.6
	(58.2)	(51.3)	(46.7)		
Total Demand	6,723	9,270	10,800	2.7	1.5
	(100)	(100)	(100)		
Electric Industry Use	5,974	8,300	9,730	2.8	1.6
	(88.9)	(89.5)	(90.1)		
Independent Generation/Consumption	749	970	1,070	2.2	1.0
	(11.1)	(10.5)	(9.9)		
Max. Demand Power (MkW) (Elec. Ind. Use)	121.45	172.5	202.1	3.0	1.6
Yearly Load Rate	59.5	58.4	58.4	-	-

( ) = Component Percentage

Points Within the Supply and Demand Forecast

Power Demand

(1) Overall Demand for Electric Power: Under the assumption that there will be constant efforts on the industrial side to rationalize the use of electric power and on the residential side to conserve the power used by home appliances, to reduce heat in residences and buildings, and to conserve the power used by OA equipment, demand is expected to expand by about 2.7 percent per year for the years 1988 to 2000 (as opposed to a GNP elasticity value of about 0.7) and by about 1.5 percent per year from 2000 to 2010 (as opposed to a GNP elasticity value of about 0.5).

(2) Independent Generation—Independent Consumption: In light of the slowing of industrial expansion which would accompany a shift toward an industrial structure with minimal electric consumption and considering new energy sources on the residential side including sunlight and cogeneration using fuel cells, demand is expected to increase about 2.2 percent per year for 1988 to 2000 and by about 1.0 percent per year for 2000 to 2010.

Electric Power Supply Targets
Generated Electricity (100 Million kWh)

	1988		2000		2010	
		Component %		Component %		Component %
Atomic Energy	1,776	26.6	3,290	35	4,730	43
Coal	636	9.5	1,560	16	1,630	15
LNG	1,414	21.2	1,880	20	2,010	18
Hydropower	886	13.3	1,010	11	1,180	11
(General)	801	12.0	850	9	990	9
(Pumped)	85	1.3	160	2	190	2
Geothermal	11	0.2	60	1	210	2
Petroleum	1,944	29.2	1,630	17	1,050	10

Electric Power Supply Targets
****Generated Electricity (100 Million kWh)** (Continued)**

	1988		2000		2010	
		Component %		Component %		Component %
Methanol	-	-	-	-	40	0.3
Dispersed Power Sources	-	-	30	0.3	250	2
Total	6,668	100	9,460	100	11,090	100

(Dispersed Power Sources: Fuel Cells, Sunlight, and Wind Power)

Power Supply

In order to assure the supply capacity necessary for a balance between supply and demand while keeping in mind the building of the most suitable power source components, it will be necessary to promote the development of various power sources on the basis of the fundamental ideas expressed above.

(1) Atomic Energy: In light of its outstanding fuel supply and price stability and economic and environmental characteristics, it will have to rank as a basic force in supply and we will have to promote its development as much as possible. However, because of the fact that there are limits to flexibility in dealing with demand increases on the basis of power source development and use planning, it has a level which is proper for the proportion of power source structure which it occupies. In addition the assurance of public acceptance is the most important factor in the utilization of atomic energy.

Power Source Make-up By Year
(Unit=Million kW)

	1988		2000		2010	
		Component%		Component%		Component%
Atomic Energy	28.7	17.4	50.0	22	72.0	27
Coal	11.12	6.7	29.6	13	40.0	15
LNG	33.06	20.1	50.3	22	53.0	20
Hydropower	36.13	21.9	44.5	19	51.7	19
(General)	19.13	11.6	21.5	9	25.0	9
(Pumped)	17.0	10.3	23.0	10	26.7	10
Geothermal	.18	0.1	1.0	0.4	3.5	1
Petroleum	55.63	33.8	51.2	22	40.2	15
Methanol	-	-	-	-	1.0	0.4
Dispersed Power Sources	-	-	1.1	0.5	5.7	2
Total	164.82	100	227.7	100	267.0	100

(Dispersed Power Sources: Fuel Cells, Sunlight, and Wind Power)

(2) Coal-Steam Fired: Because it has outstanding fuel supply stability and economic characteristics, and in spite of the fact that we are dependent on fixed quantities, it will be widely used as the base median power source with plans to improve generating efficiencies to deal with world environmental problems. As a result, although the number of facilities will increase after the year 2000, the amount of electricity that it generates will remain almost flat.

(3) LNG-Steam Fired: Because it has excellent environmental characteristics, it continues to be utilized as a power source for proximity to high demand areas. Although it will rank as a median peak power source, because a considerable amount has already been introduced, it will maintain the current share that it occupies among power sources. Active utilization will continue even as we worry about LNG procurement with long term stability.

(4) Hydropower-Geothermal: Because these are outstanding in terms of environmental burdens such as CO_2 and because they possess extremely good supply stability as domestically produced energy, their development will be actively promoted fundamentally as a basic power source. Moreover, because pumped water power generation is excellent for following daytime loads, in the future we will work at developing a fixed percentage.

(5) Petroleum-Steam Fired: As we give consideration to international agreements and strive to reduce our degree of dependency, we recognize its flexibility and operational characteristics. It will rank as a peak power source and as one with a buffer function.

(6) Methanol-Steam Fired: Suitable utilization is planned on the basis of trends toward technical development as a power source supplementing petroleum steam fired generation.

(7) Dispersed Power Sources: Development will be actively promoted in light of trends toward technical development and the local siting of demand for electricity and heat.

New Optical Technique To Promote Development of Optical Devices, Optical Computers

91P60042 Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 30 Oct 90 p 1

[Article by Shi Guoan: "Semiconductor-Controlled Spontaneous Emission Light Successfully Achieved; Opens New Paths for Development of Optical Function Devices and Optical Computers"]

[Summary] According to a report in the Japanese journal ENERGY CONSERVATION AND AUTOMATION, scientists at NTT's Basic Research Institute recently conducted the world's first successful experiment in achieving spontaneous emission in light controlled by semiconductors. The report says that, although semiconductor lasers are now commonly used as microdevices and as power sources for optical communications, their large power consumption and heat output have restricted the aggregation of the laser output. The spontaneous emission achieved by the NTT institute via controlled light has reduced power consumption to one part in several ten thousands compared to the former method and also permits improved aggregation of the semiconductor laser output. This experiment is therefore a major step forward in the development of high-capacity optical communications and of optical function devices for optical computers.

The spontaneous emission form of optical emission—as opposed to the stimulated emission form—comes from atoms in a very high energy-level state. The stimulated and emitted light is a result of "natural vacuum field wave motion." Vacuum field wave motion was first successfully controlled by a research group at the University of Washington in U.S. in 1985; the U.S. group used vacuum tubes for control.

According to the Japanese press report, the NTT research group is the first in the world to successfully apply semiconductors to control vacuum field wave motion. The new technique will prevent the loss of useless light generated by semiconductor lasers and thereby will greatly reduce power consumption. This will in the future permit the integration of 100,000 to 1 million devices onto one 1-centimeter-square chip, which will in turn permit the development of optical function devices with a very high degree of integration, as well as open new paths for the development of optical computers. Applications are also seen in the areas of high-capacity optical communications and optical detection.

Hitachi Develops Neural-Net LSI

91P60037A Shanghai DIANZI JISHU [ELECTRONIC TECHNOLOGY] in Chinese No 9, Sep 90 p 5

[Article by Chen Shanhai: "Neural-Network LSI"]

[Text] Hitachi recently trial-produced a neural-network LSI circuit. This 5-inch-diameter silicon chip, onto which are integrated 576 neurons (equivalent to 19 million transistors), was fabricated with a 0.8-micron CMOS gate-array technology. The appearance of this chip accelerates the pace of development of small, low-cost, practical neurocomputers, ultimately toward the realization of an ultrahigh degree of integration on a functional scale with that of the human brain. A human-brain-analog neurocomputer can solve [certain] problems difficult for an ordinary computer. [For example,] while a supercomputer might require six hours to process a certain problem, the neural network would only need 58 milliseconds.

New Superconducting Device with Operating Speed Higher Than That of Supercomputers

91P60048 Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 43, 7 Nov 90 p 29

[Unsigned article: "Japan Trial-Manufactures New Superconducting Magnetic Flux Quantum Parametric Device"]

[Summary] As part of the "Goto Magnetic Flux Quantum Information Project" (named after project director Prof. Eiichi Goto of the Physics Department at Tokyo University), the Creative S&T Advances Enterprise Division of the Japan New Technology Enterprise Group recently achieved the first successful trial production of a new superconducting "magnetic flux quantum parametric" device, which has an operating speed almost 100 times that of current supercomputers and a power consumption only one 1 millionth that of a silicon device. The newly developed chip—destined by agreement of the experts to be invaluable in the development of super-high-speed, low-power superconducting supercomputers—is 2.5 square millimeters; on its silicon substrate, four of the new devices are fabricated. When cooled in a liquid-helium environment (temperature of minus 269°C), all of the single devices had a measured switching speed of 30 picoseconds, a speed almost 100 times faster than the value of 2 nanoseconds for the fastest supercomputers now available. Linewidth of the trial-manufactured device is 5 microns, but when current 0.5-micron VLSI technology is applied, speed can be increased another 10 times.

The magnetic flux quantum parametric device is a new type of super-high-speed logic device developed from two Josephson devices connected together; it relies not on current but rather on a magnetic flux quantum to transfer a signal. The basic theory was first developed by Prof. Goto and a research gruop from Hitachi Ltd. in 1986. After the successful trial production of the new device, the scientists involved commented that it will open new paths for the development of a superconducting computer superior even to the Josephson computer.

New 32-Bit Microprocessor Developed

91P60037B Beijing WUXIANDIAN [RADIO] in Chinese No 9, Sep 90 p 5

[Article translated [from Japanese] by Hu Yunlin: "32-Bit Microprocessor"]

[Text] Fujitsu, Hitachi, and Mitsubishi have jointly developed the TRON-specification-based high-performance 32-bit microprocessor G-MICRO300 via a 1-micron CMOS processing technology. The new processor has 900,000 transistors integrated onto one 15.98-square-millimeter chip. At an operating clock frequency of 25MHz, the benchmark-testing performance points were 34,000 cycles per second and 17MIPS [million instructions per second]. This chip, which has a 16-bit block-transfer function (up to 80MB per second) as its main characteristic, has one 2kB ultra-high-speed instruction buffer and one 2kB ultra-high-speed data buffer, as well as 128 TLB [translation lookaside buffer] (compiler support buffer) entries; this makes the chip suitable for a multitasking operating environment. The chip will be separately sold by the three companies at an earliest date of Spring next year [1991].

JAIF Urges Public Consensus

90FE0230A Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 12 Apr 90 pp 1, 2

[Text] On 9-11 April the Japan Atomic Industrial Forum (JAIF) held its 23rd annual conference at the National Kyoto-International Hall. The keynote theme of the conference was "Problems in Achieving Harmony Between Atomic Energy and the Public" and there was a total of over 1200 participants, including both general attendees and representatives from international organizations from 20 countries around the world.

T. Enjo, the president of JAIF, first led an airing of opinions and stated that "The world now faces a new historical epoch in which a new order superseding ideologies will be built." He stressed that while this is happening, it will be necessary for Japan to play the role of pioneer in attaining a mature atomic civilization.

The president first stated that "It is natural that safer equipment and facilities will be developed for atomic power use," and then in regard to recent discussions concerning atomic energy, he went on to say that "Although there is uneasiness about the safety of atomic energy technologies and there are some people who feel that its use should be stopped, they are denying both the advance of technology and posterity's freedom of choice concerning energy sources." He emphasized that "Uneasiness about safety is not a denial of atomic energy and should probably be directed toward demands for the development of safer technologies."

T. Mukaibo, chief representative of the Atomic Energy Commission, next greeted the assembly and emphasized that "In the future we will build a record of safe operation by working even harder at assuring safety. At the same time I hope we can work to increase public knowledge about atomic energy to a degree greater than we have had to date."

K. Omae, chairman of the JAIF Annual Conference Preparation Committee, stated that "Up to now, we have spoken too little about safety in nuclear power generation," and he talked about the importance of using the conference to broaden discussion.

During Session 1, I. Szabo, a high official in Hungarian industry, stated that "We must push ahead quickly with energy development," and talked about the fact that we are expecting great things from atomic energy as an energy source.

Then during Session 3, "Why does the public have such views on atomic energy?" which was held on the second day, lively debates were held; "We have to say positively that the risk (in nuclear power) really is a risk and if this is done, people will come to be more impressed with the credibility of people in the business. This will be the first step in a dialogue." (T. Kinoue, Professor at Kyoto University) and "We should establish a legislative system in which the public holds discussions on common ground." (T. Ishibashi, lawyer)

During Session 5 in which the conference was summarized, commentator S. Tawara was made conference head and future topics were debated as they heard the atomic energy policies of both the Liberal Democratic and Social Democratic Parties.

H. Mitsuka, investigative committee chairman for a previous LDP government, stated that "As far as waste goes, it is produced no matter what form of energy is used. It is essential that it is managed safely and it is not exaggerating to say that human existence is in confrontation with waste." In regard to radioactive waste, he emphasized that "We believe that solutions are possible through technology."

S. Ito, political commission chairman for the Social Democratic Party, stated that "Up to now there has been a tendency for the opposition movement on the nuclear power side to oppose party policy no matter what. In the future we will have to consider the overall effects of the party's energy policies." He explained that after the party's general assembly last week, they were instructed by the Secretary to form policies on the basis of statistics.

Finally, Preparations Committee chairman Omae summed up the conference and formulated and then proposed a "Declaration of Interdependency Regarding Nuclear Power Generation (Proposed)" which would point out the importance of public consensus.

S. Kobayashi, conference vice-chairman, concluded the conference by stating "I hope we will embrace the declaration of interdependency and put forth our best efforts so that the nuclear industry can make this proposal come true."

The Essentials of the Declaration of Interdependency Concerning Nuclear Power Generation

The gist of the declaration of interdependency concerning nuclear power generation which was published by Preparation Committee Chairman Omae at the JAIF Annual conference is as follows:

With the advance of information, international society has quickly increased the extent of our interdependency. As this has come about, the atomic energy industry which has grown as a part of energy policy in many countries has likewise increased its stature as one of the international communities of destiny.

The TMI and Chernobyl accidents have become matters of widespread public concern and as our present recognition of environmental problems has increased, the solution of not only social and political issues, but geopolitical problems as well has become essential to the promotion of nuclear power generation. There is likewise a recognition of the fact that if another incident of the Chernobyl magnitude should occur, it will become extremely difficult to promote nuclear power generation in any country. For this reason it will be necessary for governments in all countries to continue to increase their understanding of all of these complexly intertwined

elements and to learn accurately the state of the interactive relationships of these elements.

Furthermore, interacting policy decisions impact each other in important ways and it is commonly recognized here that when assumptions concerning energy demand run up against conditions unanticipated even countries which could be said to be promoting nuclear power, all organization personnel will be greatly influenced in terms of their administration of these various energy policies. In addition, with the existence of this kind of remarkable mutual interdependence, at the present time it is recognized that no country has been capable obtaining the data, facts, and analysis necessary to formulate its overall energy policy prudently and reliably over long periods of time.

For example:

—The risks and costs of the exploitation, supply, transport, operation and wastes for oil, coal, LNG, atomic and hydropower, our principal sources of energy, and also their long-term impact on the environment and ecology.

—Whether or not we will ever be able to achieve alternative energy such as solar, wind, tidal, geothermal, and fusion which are both powerful and environmentally acceptable.

In other words our present level of knowledge is not even at a point where overall evaluation is possible in terms of economic characteristics, safety, reserves, environmental systems, ecological systems, social acceptability, timeframe, geopolitics, etc.

With this degree of uncertainty, people have been greatly concerned and have felt uneasy about atomic energy, an energy source which is difficult to understand; up to now there has not been an effective and constructive dialogue with the public. However, countries with advanced atomic energy will have to confront the present situation in which atomic energy has become an essential, decisively important source of energy.

This present situation and the estrangement of public opinion has not only caused failures in energy policies for all of Japan, but has also become a significant threat to peace and economic stability in the world. One of the causes precipitating this situation is the fact that we have not paid enough attention to investments in governmental/social questions which are very much in the forefront and which emphasize hard facts such as the safety and cost superiority of atomic energy. For this reason in the future it will be necessary for people in the industry to make active investments focusing not only on technical and economic aspects, but on social science issues as well.

—Research into the formulation of social acceptance.

—Improving techniques for dialogue with average people.

—The cultivation of experts who understand advanced technology.

In addition policy makers will have to work together toward the rapid promotion of a framework for the building of a new international order.

—From national AEC (atomic energy commissions) to international AEC.

—TQA (total quality assurance) and the transfer of technology to countries with nuclear power generation.

—The release and exchange of technology and information.

—The safe management of plutonium.

—R&D in support of energy policies which are both long-term and all-encompassing.

—Assistance in solving energy and environmental problems in developing and undeveloped countries.

We believe that the continuation of these kinds of efforts will ultimately be the shortest and best way to gain social acceptance for atomic energy and we here declare this to be our common belief.

Construction of Five Nuclear Plants Expected in the Next Two Years

90FE0230B Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 19 Apr 90 p 1

[Text] On 13 April the Ministry of International Trade and Industry (MITI) completed and released the details of the 1990 Electric Power Construction Plan presented by the nation-wide electric industry. According to the plan, peak Japanese electric power demand for the year 1999 is expected to be 169.21 million kW (an average yearly increase of 3.1 percent) and in order to meet this demand the industry is expected to submit a plan to the Electric Power Development Coordination Council for the next two years for 4.74 million kW in nuclear power (five plants), 3.48 million kW in steam fired power (13 plants), and 1.79 million kW in hydropower (33 plants), for a total of 10.01 million kW.

According to the plan, total demand for electric power in Japan ten years from now in 1999 is expected to be 908.8 billion kWH (an average yearly increase of 2.8 percent). Compared to previous forecasts, this is an upward correction of 0.1 percentage points in average yearly increase.

Within this demand, against a background of qualitative increases in housing levels which will accompany increased demand for amenities and an improved standard of living, public welfare demand is expected to increase greatly at a yearly rate of 4.1 percent. On the other hand industrial demand is expected to rise at an average yearly rate of 1.7 percent.

Peak electric power in 1999 is expected to be 169.21 million kW (an average yearly increase of 3.1 percent). Compared to previous forecasts, this is a decrease of 0.1 percentage points for average yearly increase. This is due to the fact that although the load rate will continue to decrease in the future, the rate of decease is expected to be slower than forecasts in previous years.

In order to respond to this demand, MITI has decided that "In the next 10 years it will be necessary construct generating plants as follows: 7.76 million kW of hydropower, 32.51 million kW of steam fired power, and 18.86 kW of nuclear power."

Under this fiscal year's Electric Power Construction Plan, "We will begin construction planning and submit power development plans to the Electric Power Development Coordination Council for 21 hydropower sites with 90,000 kW, three steam-fired sites with 2.03 million kW, and one nuclear power site with 610,000 kW. For 1991 we will do the same for 12 hydropower sites with 1.7 million kW, 10 steam fired sites with 1.45 million kW, and four nuclear power sites with 4.13 million kW."

The nuclear power plant which is expected to be submitted to the Council for this fiscal year is at Oma (ATR, 606,000 kW output, expected to begin operation in March, 1999). The sites expected to be submitted for FY91 are Higashidori (Tohoku Electric Power, 1.1 million kW, expected to begin operation after 2000), Namie-Kodaka (Tohoku Electric, 820,000 kW, expected to begin operation after 2000), Ashihama No 1, 2 (Chubu Electric, 1.1 million kW each, expected to begin operation in 1999-2000).

As a result of this program, by 1999 power sources are expected to be composed of 43.96 million kW of hydropower (a 19.6 percent share), 131.95 million kW of steam fired power (a 58.9 percent share) and 48.14 kW of nuclear power (a 21.5 percent share). Electric power generating shares for FY99 are expected to be approximately: nuclear power, 33 percent; LNG, 20 percent; petroleum: 18 percent; coal, 15 percent; and hydropower, 11 percent.

Laser Uranium Enrichment Laboratory Completed

90FE0230C Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 17 May 90 p 2

[Text] The Laser Enrichment Technology Research Association has been looking into uranium enrichment using the laser method and on 14 May they announced that they had recently completed their experimental device facility constructed within the Japan Atomic Energy Research Institute's Tokai Research Center. The facility is scheduled in July to begin regular uranium enrichment testing involving a total system combining both laser and separation equipment.

Construction on the experimental device facility has continued since June of last year.

The facility has been set up as a total system with elementary equipment such as lasers, separators, and evaporation-recovery devices on which many improvements have been made. Beginning in July they will use the equipment for shake-down operation in preparation for regular continuous operation and for basic testing for obtaining baseline data for each of the devices.

In practical terms they will gather data including photoionization characteristics and dissociated ion recovery characteristics by performing adjustment operation of the laser and separation devices. In this way they intend to improve the uranium recovery efficiency by varying operational conditions such as laser output and uranium vapor density characteristics. After they have performed this type of basic experimentation for approximately half a year, they plan to set up the necessary supplementary devices and to begin basic experimentation by next fiscal year.

In their experiments they will not only perform about 200 hours of continuous operation and run uranium enrichment tests with a target scale of one ton SWU per year, but will also confirm both overall system performance and reliability under continuous operation.

Basically, uranium metal is heated to high temperature using an electron gun, uranium atoms are vaporized, laser light is beamed onto the uranium vapor and only the uranium 235 is selectively excited. There is an additional procedure in which ionization is caused by laser beaming and recovery is made using a cathode low enrichment uranium recovery plate. Because its separation efficiency is a great improvement over existing methods such as gas diffusion, if it can be made practical, its economic characteristics will have great appeal.

The area of the experimental device facility site is 9600 square meters. The area of the building is approximately 3600 square meters. A part of the building has two stories. The cost for construction and testing will be approximately ¥8 billion. Staffing will be about 80 personnel.

Nuclear Power Utilization Rate Tops 70 Percent]

90FE0230D Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 12 Apr 90 p 2

[Text] According to a study by the Japan Atomic Industrial Forum, the facility utilization rate for Japanese nuclear power generating plants (including the "Fugen") was 70 percent for FY89. Although this is a slight drop from 71.4 percent for the previous year, this is the seventh continuous year in which the 70 percent level has been achieved and high operational percentages have become a fixture.

Looking at the trends in the facility utilization rate for 1989, because April, May, and June was the time for periodic inspections anticipating the summer demand period, approximately ten reactors entered periodic inspection all at once and the utilization rate shifted to

the middle of the 60 percent level. However, as we entered July, with five reactors resuming operation one after another and with favorable work at Tomari #1 which had resumed operation the month before, the rate rebounded nicely to 79 percent. By August three more reactors resumed operation and the utilization rate rose to the 80 percent level. During September four more reactors entered periodic inspection, resulting in a 73 percent utilization rate. Thereafter, October had 69 percent, November 69 percent, December 72 percent, and January 68 percent, thereby showing a solid shift to around 70 percent. In February periodic inspections mounted, resulting in a 60 percent utilization rate and hitting the low point of the year, but in March the rate recovered to 66 percent.

The PWR utilization rate for last fiscal year was 74.6 percent and the BWR rate was 66.5 percent. The Ministry of International Trade and Industry (MITI) feels that the reason for the favorable BWR rate "can be considered to be the fact that the number of periodic inspections has decreased compared to previous years and the fact that there have been fewer instances of primary coolant pump circulation vane attachment bolt replacement work." They feel that the reason for the decreased BWR utilization rate "can be considered to be the fact that the periodic inspection period for Reactor 3 at Fukushima #2 was greatly extended."

MITI has stated, "When utilization rates (calendar year) for the major countries are compared, the Japanese rate is virtually the highest."

On the other hand the average period for continuous operation in Japanese nuclear power plants reached 347 days. This is an 11 day increase over the previous fiscal year.

According "Nuclear Power Incident/Problem Statistics for FY89" which MITI released on April 6th, the "number of incidents/problems" for last fiscal year was 22 (0.6 incident per reactor), thereby maintaining an extremely low level. When this total is broken down, there was one instance of automatic shutdown during operation, ten instances of manual shutdown during operation, and ten incidents discovered during reactor shutdown. In all cases there was no radioactive impact on the surrounding environment.

New Method of Uranium Enrichment Gains Successful Result

91FE0107B Tokyo GENSHIRYOKU SANGYO SHIMBUN In Japanese 6 Sep 90 p 1

[Text] Japan Atomic Energy Research Institute (JAERI) is proceeding with nuclear laser technology for uranium enrichment and it has announced that major developments have been obtained pertaining to the economics of uranium enrichment by nuclear laser methods. As a result of performing demonstrations to evaluate uranium 235 separation capability with natural uranium as the starting material for four days, 0.01 grams per hour of enriched uranium with a degree of enrichment of 5 percent or more was successfully recovered and the recovery rate of uranium 235 was increased to 65 percent.

JAERI Achieves Uranium 235 Recovery Rate of 65 Percent

By means of uranium enrichment by nuclear laser technology, uranium 235 is only selectively enriched by irradiation of evaporated uranium atoms. JAERI began studies of this method beginning in 1984.

The main results of the current studies were: (1) 0.01 grams per hour of enriched uranium with a degree of enrichment of 5 percent or more, which is important for practical use, was successfully obtained, (2) a uranium 235 recovery rate of 65 percent was achieved, and (3) an enrichment energy efficiency of 4 grams SWU/KW hour, which is approximately ten-times that with gas diffusion, was reached. All three of these findings were the highest standards from among international data that has been announced.

Uranium enrichment by nuclear laser technology was presented in data pertaining to theoretical demonstrations by Lawrence Livermoore National Research Laboratory of the U.S. in 1974 and JAERI was the second in the world to initiate basic research beginning in 1976. Moreover, approximately 100 micrograms of 24 percent enriched uranium was successfully recovered as a result of theoretical demonstrations in 1982. Basic engineering studies were started in 1984 and led to the current results.

In the studies, metallic uranium is impacted and heated by an electron beam to produce zonal uranium vapor. On the other hand, a color laser is operated by a 200 hertz excimer laser and the color laser light of high monochromaticity that is generated irradiates uranium atoms so that they fly at a speed of approximately one thousand meters per second. As a result, the uranium 235 is selectively excited and ionized. Furthermore, an electric field is applied to these ions and the uranium 235 is recovered on an electrode plate. In addition, it is estimated that the separation capability of the laboratory device operated on an experimental scale in the current study is approximately 0.5 kilograms SWU/year.

The "Laser-Enrichment Technology Research Group" was established in 1987 to perform practical research of uranium enrichment using nuclear laser technology. This group has been cooperating with JAERI and is performing studies aimed at producing on the order of one ton SWU/year. However, JAERI also hopes to continue with basic research, such as development of methods for recovery of uranium of a higher atomic density and studies of wavelength combinations at which superior photoionization efficiency is provided, in order to further improve uranium 235 recovery efficiency and energy efficiency.

Modified JRR-3 Passes Trial Operation

91FE0107A Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 13 Sep 90 p 5

[Article: Modified JRR-3 Complete 100 Hours of Trial Operation: JAERI First To Use Low Enriched Fuel in World"]

[Text] The Japan Atomic Energy Research Institute (JAERI) completed a high-output, long-term operation of the JRR-2 modified reactor, which was the first in the world to use low enriched uranium fuel (20 percent enriched, uranium-aluminum dispersion fuel).

Once the JRR-3 modified reactor reached the first threshold on 22 March this spring, studies confirming various properties were performed for approximately five months while gradually increasing reactor output and JAERI has confirmed that the various reactor properties are very close to design values. Continuous operation at the final maximum thermal output of 20,000 KW was started from the third day and the reactor safely completed 100 hours of operation in seven days.

JAERI will immediately perform an official inspection before commercial operation and it anticipates that once this inspection is passed, use of the reactor will start in early November.

Modification of JRR-3 was performed by a unique process whereby the old reactor body is cut away from the periphery and lifted and moved with a jack and a completely new reactor is installed in its place. In light of nuclear nonproliferation policies, the new regenerated reactor does not use high-enrichment uranium fuel (approximately 93 percent enriched). It employs the newly developed low enriched uranium fuel (approximately 20 percent enriched). It is also the first large research reactor that uses low enriched fuel for all of the reactor fuel.

In addition, property studies are being performed on the first large cold neutron generator in Japan and it has been confirmed that it generates the desired cold neutron flux. Cold neutrons have low energy and will throw light on the molecular structure of matter.

JAERI plans to finish commercial power loss studies, during the last part of September with its successful completion of 100 hours of continuous operation at maximum thermal output of 20,000 KW, and to initiate experimental operation at the end of October or beginning of November, with one cycle consisting of five weeks (four-week continuous operation, one-week preliminary).

New Technology for Group Partition Developed

91FE0107C Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 16 Aug 90 p 2

[Article: "New Technology for Group Partition Developed: Japan Atomic Energy Research Institute Efficiently Recovers TRU"]

[Text] Japan Atomic Energy Research Institute (JAERI) recently developed a series of group partition processes whereby 99.9 percent or more of transuranium elements (TRU), such as neptunium, plutonium, etc., and rare earth elements (RE) are partitioned and extracted from high-level waste liquid with the extraction agent DIDPA (diisodecylphosphoric acid) that it developed and oxalic acid.

In particular, by means of this method it is possible to extract 99.96 percent or more of neptunium, which has a very long half-life and is generally difficult to extract, and therefore, major strides will be made in group partition research by this technology.

By means of the extraction method developed, first zirconium, molybdenum, tellurium, etc., are partitioned and extracted from high-level waste liquid obtained by dilution of nitric acid to 0.5 molar concentration and DIDPA extraction agent is added to the remainder and the TRU, such as americium, neptunium, etc., and rare earth elements are extracted in the DIDPA. Next, back extraction of americium, curium, and RE is performed using a nitric acid solution and neptunium and plutonium are back extracted using oxalic acid in the final stages.

At this time, a bottleneck forms in that the extraction speed of the pentavalent neptuminum in DIDPA is very slow. However, as a result of research it was shown that the extraction speed can be increased by adding hydrogen peroxide. Thus, good results are obtained because 99.96 percent or more of neptunium can be efficiently extracted.

Furthermore, simulation waste liquid of neptunium 237 obtained from the British company of [Amarsham] International was employed in this research.

Japan is currently proceeding with research and development of group partition technology of a method for partition into the four groups: (1) a transuranium element group, (2) a technetium-platinum element group, (3) a strontium-cesium group, and (4) an other elements group.

Moreover, this research has major advantages from various aspects in that the amount of high-level waste solids produced by group partition can be reduced to approximately ½ when compared to the case where the total amount is vitrified, TRU is annihilated as it is used as a heat source by transmutation to a nuclear species by fast neutrons, or rare noble metal elements are recovered. In the future, JAERI hopes to proceed with experimental research using actual waste liquid at its Nuclear Fuel Cycle Safety Engineering Research Facility (NUCEF), which is currently under construction and should be completed in 1992.

FBR Demonstration Reactor Design Selected

91FE0088A Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 14 Jun 90 p 1

[Text] On 13 June at a meeting of company presidents the Federation of Electric Power Companies approved the selection of the top entry loop-type reactor (output 600 to 800 MW) as its object reactor for "preliminary conceptual design research" for its demonstration fast breeder reactor (FBR). It was decided in the future to perform conceptual design research for the purpose of confirming, with a target date of the end of FY90, the technical feasibility of the loop-type reactor chosen here. Japanese FBR development has thus entered a new stage.

The purpose of this selection of reactor type was to attempt to make the research more efficient in terms of executing conceptual design studies for choosing a basic style for the demonstration reactor which will be the next step following design evaluation studies which are ongoing at present.

There were two choices for selection: the top entry loop-type reactor in which the primary pieces of equipment are dispersed and connected to one another by piping shaped like an inverse U and the tank-type reactor which is being built in Europe as a demonstration reactor. At the present time neither reactor type is capable of competing with light water reactors and in terms of evaluation, they both have their advantages and disadvantages. However, because the Power Reactor and Nuclear Fuel Development Corporation has gained a mass of experience with loop reactor research and development, it was chosen from the standpoint of R&D continuity. In selecting this reactor type, they gave a prior briefing on 11 June to the FBR Development Design Specialist Subcommittee of the Japan Atomic Energy Commission and were given its approval.

Demonstration reactor development is an important stage in achieving a practical reactor. In regard to this decision, the government stated that "Its significance is great from the standpoint of taking the design R&D phase one step further and it is important that its development will progress further on the basis of past R&D experiences."

In regard to recent Japanese FBR development, construction on the "Monju" prototype (280 MW output) has been ongoing with a goal of criticality by October 1992. Research on the demonstration reactor is proceeding with a goal of operational startup after the year 2000.

In 1986 it was decided that the Japan Atomic Power Co. would be the principal organization for construction and operation in the development of the demonstration reactor. Up to now demonstration reactor design evaluation studies have proceeded under the leadership of the electric power industry.

Long Term Nuclear Power Development Strategy

91FE0088B Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 21 Jun 90; 28 Jun 90

[21 Jun 90 p 1]

[Text] On 15 June the Atomic Energy Subcommittee of the Advisory Committee for Energy completed its report on a long-term strategy for atomic energy development. The report incorporated measures and issues relating to the achievement of developmental goals set forth in the long range energy supply and demand forecast through the year 2010 which the Committee had already completed. Although recognizing that "a concerted effort will be necessary to meet the goals" and that this will be difficult in light of present social conditions, they decided that with the increasing demand for energy, atomic energy in particular will be essential to power supplies and they proposed taking dramatic measures in areas including safety assurance, backend [postprocessing], siting promotion, and public information. Specifically, they produced a new strategy involving, among backend measures, the early establishment of an action program for high level wastes and among public information measures, the establishment of a system for information dissemination.

In regard to the extent of atomic energy development proposed in the long range energy supply and demand forecast, they produced a path to increase development to double the present-day plant to 72,500 MW by the year 2010. Over the next 10 years the pace of development will be about 20,000 MW and this could be called a steeply pitched route to development which is faster than the developmental pace (16,200 MW) over the last 10 years (1979-1989).

In their report in regard to achieving these developmental goals, they state that "In order to reach our goal (50,000 MW) for the end of FY2000, we will have to continue our best efforts so that power plants both under construction and under planned construction will begin operation without fail." In spite of this they realize that conditions are difficult and "understand the great difficulties we will have in reaching these goals by FY2010 in light of recent changes in societal attitudes toward atomic energy. A great effort will be necessary to achieve this scale of development." In addition they pointed out the necessity of recognizing the fact that among the increased concerns that the public has regarding atomic energy, there is a feeling that information has generally been inadequate. They also emphasized the necessity of establishing siting promotion measures for "coexistence with localities" which stress increased soft benefits in addition to a core of hard benefits. In addition they offered the following as important strategic issues: 1) safety assurance measures, 2) backend measures, 3) siting promotion measures, and 4) public information measures.

Among safety assurance measures, in planning a safety regulation and safety assurance system they emphasize

the importance of the establishment and implementation of a system to efficiently and effectively deal with items such as degradation over time and waste reactors, new concerns which are projected for the future. In addition they determined that there should be a study concerning the granting of partial responsibility to third-party organizations for regulation operations concerned with inspection and operational management, work which the government now performs. Out of a recognition that accidents are a source of concern to the public, they also advocate the building of a trouble information database and the establishment of a system for information dissemination.

Among backend measures, they emphasize in particular that "it will be necessary to make public at an early date an action program relating to the treatment of high level radioactive wastes and the government and the public will have to work together on its implementation." On the other hand they also want to actively promote both the low level waste/recycling facility being built in Rokkasho-mura and the up-grading and implementation of related technologies.

Of all these measures, siting promotion is the most important and will be the focus of the future. Specifically, as part of a strengthening of the soft side, they hope strongly for qualitative improvements in measures which, as a result of stable employment, material security, and the creation of a vision for the long term development of an area, would deal with commercial siting promotion, the growth of local industries, the cultivation of talented individuals responsible for regional promotion, and an "era of affluence" due to cultural and artistic enrichment.

Public information measures at the national level are a major key to working toward public consensus in the sense of bridging the gap between energy policy and public understanding and they have set forth a public information strategy which is "open, consistent, and established from the viewpoint of its recipients." One measure is the establishment of a system for the dissemination of atomic energy information. We will have to actively make progress on 1) the cultivation of the talented individuals needed for grass roots public relations and the establishment of an information system which will be easy for anyone to access, 2) the production of public information software, 3) analyses of the public mood, and 4) studies concerning methods of communication. In addition they have proposed increased public information targeted toward women and young people.

[21 Jun 90 p 6]

[Text] As stated on page one, in a report completed on 15 June, the Atomic Energy Subcommittee of the Advisory Committee on Energy demonstrated a recognition of the fact that atomic energy will be essential to energy supplies and advocated 1) public information measures which, in recognition of the poor state of social acceptance, would work toward building a system for information dissemination and 2) the development of quality siting promotion measures with both hard and soft aspects. In this article we will present the details of the report and focus on the current state of atomic energy and its future problems. Having passed through various stages, atomic energy at the present time appears to be firmly established as an energy source which is essential to Japanese energy supplies. However, in regard to how atomic energy will stand in terms of future Japanese energy policy, it will be necessary to study and adequately assess the following conditions surrounding present day atomic energy.

First of all, with steady increases in energy demand expected throughout the world and in developing countries as well, there is fear that we will see resource restrictions including another tightening of petroleum supply and demand. Secondly, as world environmental problems such as global warming invite world concern, the major problem becomes how to build an energy supply infrastructure which can respond to the increasing demand for energy. The third thing is that with the impact of the accident at the Chernobyl nuclear power reactor in the Soviet Union atomic energy exploitation has become difficult throughout the world.

The study by the Advisory Committee for Energy addressed these points and as a result various subcommittee reports and energy supply and demand forecasts were produced with the year 2010 as the target year. These reports 1) on the demand side strongly support increasing overall energy efficiency and 2) on the supply side the building of an energy supply infrastructure based on increasing the non-fossil proportion of energy supply and stressing further reductions in our degree of petroleum dependency, all from the standpoint of guaranteeing energy security and promoting policies to counter global warming while keeping in mind the stabilization of international energy supply and demand.

In building this kind of energy infrastructure, they expect the utilization of atomic energy to reach 50,500 MW by FY2000 and 72,500 MW by FY2010.

In regard to the future Japanese balance in energy supply and demand, the Atomic Energy Subcommittee in all sincerity stopped short of saying that these figures will be absolutely essential and at the same time they could not help but recognize the fact that in light of the recent social situation surrounding atomic energy, the goals will be difficult to achieve without a special effort to make the utilization of atomic energy acceptable to the Japanese people.

In all of this the relationship between energy supply and demand and earth environmental problems such as global warming and acid rain have come to invite worldwide concern. In expecting steady future increases in the world demand for energy even in developing countries due to the continuation of favorable business

conditions and increases in the quality of life worldwide, it is thought that in the future the major energy policy questions for Japan will be what kind of energy supply to consider in stressing harmony with the world environment and what percentage should atomic energy occupy in this supply.

The Special Characteristics of Atomic Energy and Its Place in Energy Policy

(1) The Necessity of an Appropriate Energy Mix

The first problem in building the future Japanese energy mix will be the reduction of our petroleum dependency from the standpoint of assuring world energy security. A second problem will be increasing the proportion of non-fossil fuels as a way of dealing with the problem of global warming.

(2) Placing Atomic Energy Within the Energy Mix

In comparison with other forms of energy atomic energy has good quantitative supply stability at low prices and is outstanding from the standpoint of internationally contributing toward work on world environmental problems and balancing international energy supply and demand. Consequently, although there are problems with its acceptance by society, from the standpoint of dealing with the above mentioned problems, atomic energy can be considered an outstanding form of energy. For this reason it can be said that atomic energy will be essential to the realization of an appropriate energy infrastructure for supplying electric power, the energy form which is expected to shoulder most of the burden in appropriate energy mixes and especially in future increases in the demand for energy. Thus it can be said that atomic energy should play an important role.

In building an appropriate energy supply infrastructure, after evaluating the special characteristics of each of the energy sources, it will be necessary to maintain an appropriate balance so that we are not overly dependent on a single type of energy source. At this time electric power is a form of energy with good social characteristics essential to the public welfare and when one looks at the fact that a supply which is stable in terms of both price and quantity will be a national issue, it will be important to have a way of thinking which makes "the assurance of a strong supply capability" a major goal, but which also considers the "reduction of supply costs" and "improving harmony with our socioeconomic environment." In regard to these goals, in order to "assure strong supply capability," it will be necessary to first consider fuel supply stability and the operating characteristics of each of the sources of electric power. We will also have to consider construction and operational flexibility from a new perspective allowing for timeframe differences in power source makeup. Furthermore, in regard to indices for "improving harmony with the socioeconomic environment," it will be necessary to make new additions from the standpoint of aiming toward a power source makeup which can respond without fail to the demands of the times while also dealing from a more international perspective with both trends in world environmental problems and the anti-nuclear movement.

From this perspective, when one considers energy policies for the beginning of the 21st century, atomic energy will be an energy source which is essential to striving for the "assurance of a strong supply capability" and the "reduction of supply costs." At the same time when one looks at the reality in which we will not be able to expect too much from non-fossil power sources such as hydropower and geothermal energy, atomic energy will be an important energy source for dealing with the problem of global warming. On the other hand when one takes into consideration the fact that atomic energy has limited flexibility in dealing with demand increases from the standpoint of power source development and operational planning, it will have to be introduced with appropriate levels in mind.

Table: Number of Operational Startups, Number of Startup Sites, and Lead Times in 10 Year Timeframes (A reduction in new sites increases construction at existing sites. Leadtimes extend through operational startup at new sites.)

Operational Startup Era	Number of Reactors	Number of Sites	Average Leadtime for New Sites
1970's	20	10	7.9 years
1980's	16	5	16.4 years
1990's	16	2	26.8 years

Note 1: The objective of the study was nuclear power plants decided upon by the Electric Power Development Coordination Council.
Note 2: Average leadtime is the average amount of time from site selection to operational startup. (Study by the Agency of Natural Resources and Energy)

(3) Atomic Energy As an Important Energy Source in the 21st Century

Looking beyond the beginning of the 21st century, unless we make a major effort to develop revolutionary technologies such as nuclear fusion, or unless there are amazing changes in the international energy resource situation, the importance of atomic energy (the utilization of nuclear fission) will probably remain unchanged and we will have to continue with constant development in the future as well.

Problems in the Future Direction of Atomic Energy Development

Atomic Energy's Expected Scale of Development

Because maximum efforts will be necessary both in energy conservation and the utilization of non-fossil energy, the goal set for atomic energy as a unique energy source which is quantitatively reliable should be to achieve increases in supply quantities as follows, while also obtaining the understanding of the general public.

—By the year 2000 the goal will be an increase from the 42,800 MW attainable with plants now under construction to 50,500 MW.

—By the year 2010 the supply capacity anticipated from atomic energy is expected to rise to 72,500 MW.

The pace of development will be approximately 20,000 MW every 10 years, a pace that is an increase over the pace (16,200 MW) for the last 10 years (1979-89).

Future Issues in Atomic Energy Development

(1) The Severe Environment Surrounding Atomic Energy Development

While the overall demand for energy is expected to expand faster than it has up to now, the scale of atomic energy exploitation will have to be revised downward. Under such conditions these supply and demand forecasts were dawn up to assure as much as possible a balance between supply and demand. For this reason, to achieve the utilization goal for the year 2000, it will be important to continue with our best efforts to continue to start up operations at all nuclear power plants both under construction and in preparation to begin construction, while winning the understanding of the regions concerned. On the other hand in light of recent changes in the social situation in regard to atomic energy, figures have been revised downward relative to those up to now and we recognize the fact that it will be difficult to achieve the above mentioned supply goals, especially the goal set for construction startups for new development by the year 2010. A special effort will be necessary to achieve this scale of development.

First of all, under the influence of the nuclear power generating accident in the Soviet Union as the cause of the "uneasiness regarding atomic energy safety and radioactive waste policies" which is behind the changes in public attitudes toward atomic energy, we will have to recognize that there are both a "lack of sense of trust regarding the Japanese safety assurance system" and a "feeling that information has generally been inadequate." It is thought that unless there is a rapid effort to work toward eliminating these attitudes, it will be difficult to obtain public acceptance for the continued development of atomic energy.

It is also hoped that in an era of affluence there will be better long term siting measures leading to co-prosperity and co-existence between regions and their atomic energy facilities. With only the hard regional measures we have had up to now, regional acceptance will be in for some tough going. Among the 12 nuclear reactors now under construction, ten are expansions of existing sites and two are new sites. The situation has already evolved so that new sitings are relatively difficult and in order to continue with development at a 20,000 MW pace over the next 10 years, we will have to study regional needs and establish appropriate siting measures.

Consequently, it will be difficult to achieve the above mentioned supply goals unless in the future we make a special effort to obtain acceptance by humbly responding to the needs of the public on the basis of these points and establishing measures which are good enough to gain regional siting acceptance.

(2) Issues Which Should Be Addressed Soon

As subcommittees, the Council looked at specific issues which will have to be addressed quickly in order to advance the future development of atomic energy and incorporated them into their studies after distilling them down to the following four areas.

(1) Measures Assuring Safety (The study of safety assurance measures which instill a sense of public trust regarding the course of development and utilization)

(2) Backend Measures (The study of appropriate post-processing measures so that the use of atomic energy can advance while striving for harmony with the environment)

(3) Siting Promotion Measures (The study of how to bring about a new era of co-prosperity and co-existence between regions and their atomic energy facilities)

(4) Public Information Measures (The study of how to bring about the active dissemination of information regarding the results of (1) through (3))

[28 Jun 90 p 6]

[Text] We are presenting a series of articles on the report completed on 15 June by the Atomic Energy Subcommittee of the Advisory Committee for Energy and in this article we will present a summary of specific measures concerned with how to achieve a developmental goal of 72,500 MW by FY2010. We will also focus on the basic topics covered in the report: 1) safety assurance measures, 2) siting promotion measures, 3) backend measures, and 4) public information measures.

Safety Assurance Measures

Future Areas

To promote nuclear power generation, it will be necessary to perform studies with a technical perspective regarding new problems arising out of its development and utilization. It will also be important to ease public concerns regarding nuclear power generation and to

push ahead with studies regarding safety assurance measures with the intent of increasing its acceptance by society. The following are issues which should be studied at an early date:

(1) Dealing with the advance of nuclear power generation development and utilization

—Dealing with the quantitative and qualitative changes in safety assurance measures which will follow increases in the number of plants and the extension of operating terms

(2) Promoting technical developments in safety assurance

—Working on studies concerning the development of improvements for light water reactors and measures to counter their degradation over time.

(3) Easing concerns regarding nuclear power generation

—Creating a sense of trust in regard to safety regulations and safety assurance measures.

(4) Strengthening international cooperation in the field of safety

—Dealing with the increased need for international cooperation activities in the safety field.

Actions To Be Taken

(1) The Perfecting of the Safety Regulation and Safety Assurance System

In regard to our system of safety regulation, it will be necessary to strive for the creation and perfection of a system which is capable of effectively and efficiently dealing with qualitative changes due to the emergence of issues such as measures to deal with degradation over time and rapid increases in safety related work, severe accident problems, and problems with actions to ban nuclear reactors, all of which are imaginable in the future.

In this case, from the standpoint of striving to augment the safety regulation system, we should study the idea of giving partial responsibility to third party organizations for regulatory work concerned with inspection and operation, duties which the government currently performs.

In order to deal adequately with the above mentioned changes in circumstances, the electric power industry will also have to push ahead with the perfection of its own security systems.

In regard to the perfecting of a safety regulation and safety assurance system which can adequately deal with these kinds of future quantitative and qualitative changes in safety related work, we should work as fast as possible with a goal of completing its establishment within several years.

(2) The Dissemination of Information Concerned With Safety Assurance in Nuclear Power Generation

Up to now information concerning nuclear power generation has generally been made public with the exception of those items which would have been inappropriate from the standpoint of prohibiting the theft of fissionable materials or protecting property rights such as commercial know-how.

Nevertheless, the public feels that information has been inadequate and this has been one of the reasons for both the feeling that nuclear power generation is unsafe and the decreased sense of trust concerning safety regulation. Because of this we plan to establish a means of information dissemination which will give the public rapid and easy access to more appropriate, easily understandable information. At that time, bearing in mind limitations in labor and capital, something which should be done with all due haste is the building and making available of an information database regarding accidents and problems, an area of special concern to the public. We should also plan on the periodic dissemination of information relating to safety inspections and on diversifying the ways of disseminating safety related information including the results of various types of demonstration tests.

(3) The Strengthening of International Cooperation

There has been an increased importance to dealing with nuclear power related safety problems from a global perspective and Japan has been asked to make active contributions as a country with advanced nuclear power generation. In addition new technical developments require large amounts of time and money and for reasons such as this there are many difficulties with a single country working on them by itself. Because of this it will be necessary to raise the international level of safety through international cooperation and to make active use of human resources and those technologies in which each country excels.

To this end, between advanced countries and international agencies there should be 1) an increase in safety related information exchanges and 2) active promotion of international cooperative technical development projects.

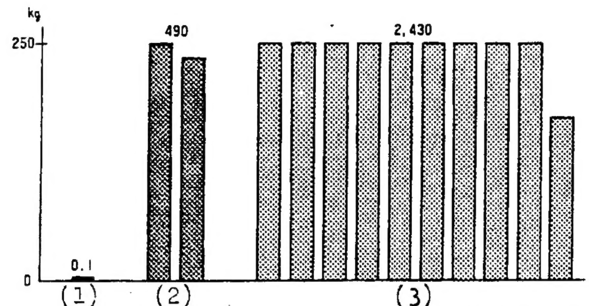
In addition, for developing countries which are actively working toward the development and utilization of nuclear power generation, it will be necessary to strengthen technical cooperation in the form of sending experts, receiving trainees, etc., each in accordance with its level of development and utilization.

Backend Measures

Future Measures and Issues

(a) Early Realization of Ways to Reprocess/Recycle

While continuing to promote construction planning for the private sector recycling facility in Rokkasho-mura in



Amount of Waste Generated Per Individual Japanese (Per Year)

Key: 1. Radioactive Waste—2. General Waste—3. Industrial Waste

Aomori Prefecture, a site which is essential to the Japanese nuclear fuel cycle, it will be necessary from an even more long-term perspective to plan on improving reprocessing techniques in the private sector so that industry efficiencies will improve. In addition an effort lead by electric power industry personnel should deal actively with FBR (fast breeder reactors), ATR (advanced thermal reactors), and Pu-thermal (plutonium use in light water reactors).

(Total for general/industrial waste: approximately 3,000 kg = equivalent to a volume of approximately 4 m^3(one truckload). Total for radioactive waste: approximately 0.1 kg = equivalent to about 40 cc (one egg).)

Source: "Current Situation and Problems in Processing and Recycling Waste" by the Administrative Inspection Bureau of the Management and Coordination Agency.

(b) Establishment of Measures for Radioactive Waste Processing and Disposal

In the future it will be necessary to work actively on the implementation of measures for radioactive waste processing and disposal. To this end we will have to continue to promote planning for construction of a low level waste treatment facility. In addition we will have to make public at an early date an action program for high level radioactive wastes and work with both the government and the people on its implementation.

Siting Promotion Measures

First of all, in order to erase the sense of uneasiness that regional residents have about the safety of atomic energy, it will be important in a concrete sense to coordinate the national release of information and at the same time promote multi-level, multi-dimensional information releases for individual areas. Secondly, in order to work toward qualitative changes in expectations regarding the effectiveness of regional promotion for power source areas, in addition to the assistance of hard items such as the maintenance of public-use facilities already in existence, it will also be important to have assistance studies regarding the dramatic growth and maintenance of the region's broader industrial base, an item which forms the basis for the soft side of power source promotion policy.

Actions To Be Taken

(1) Promoting the Multi-Level, Multi-Dimensional Release of Information for Individual Regions

The establishment of a public information system which brings together industry personnel, the national government, and local self-governing bodies.

In order to promote the effective release of information for individual regions, it will be important for the mainstays of public information work, industry personnel, the national government, and local self-governing bodies to strengthen coordination through information exchanges with appropriately divided responsibilities.

(2) Perfecting Regional Promotion Policies

Against the background of the arrival of an "era of affluence" with its qualitative improvements in the public's standard of living, within power source regions there will be qualitative changes in expectations regarding the results of regional promotions resulting from atomic energy sitings. In order to cope with these changes and assist in a region's long-term self-reliant development, in addition to the expansion of hard measures such as the building of industrial parks and the maintenance of existing public facilities, soft measures will also be important: planning for dramatic increases in assistance measures and for assistance in establishing broad industrial bases as a part of power source regional stimulation. Specifically, in terms of soft assistance it will be important to plan for the implementation of extremely broad assistance measures including the creation of a vision for long-term development of a region and bringing about 1) policies which nurture regional industry and encourage industrial sitings so that stable employment and livelihood are assured and which cultivate talented individuals who will work at regional promotion and 2) policies conducive to the creation of a way of life which affords regional residents cultural and artistic enrichment.

Public Information Measures

Three Basic Areas

In retrospect the public has not been given an altogether adequate understanding of atomic energy and under these circumstances there are three basic issues which must be overcome.

(1) Increased understanding and acceptance of atomic energy development by the middle class which forms the foundation of our nation and which feels vaguely uneasy about atomic energy.

(2) Elimination of feelings of uneasiness and distrust concerning whether the safety management system run by administrative and industry personnel is thorough and complete.

(3) Atomic energy safety regulation and the decision to utilize atomic energy have not come under public scrutiny. Elimination of the suspicion that information has been inadequate and feelings of distrust as to whether adequate information in this regard has been made public.

Actions To Be Taken

(1) In order to cultivate a sense of trust toward those involved in atomic energy (consisting principally of those in administration and the industry),

—Three basic rules for carrying out information releases:

In order to instill a sense of trust, we should pay attention to the following three rules regarding attitudes toward public information:

(a) Attitude Toward Open Public Information

This means actively listening to the people and responding to them so that we can confirm that the necessary information has been adequately offered.

(b) Attitude Toward Consistent Public Information

This is an attitude in which consistent information is developed in detail, responsibly, with self-confidence on the basis of long term expectations after having given adequate recognition to the importance of energy supplies, the foundation of our economic society.

(c) Attitude Toward Public Information Which Takes the Recipient's Point of View

This means that the information released takes the point of view of the public, our livelihood, and is conscious of its concerns and problems.

(2) Building a Foundation for the Strengthening of Atomic Energy Information Dissemination Functions

With the public's general awareness that both the information necessary to understand atomic energy and opportunities to receive it have been inadequate, it will be necessary to strengthen these functions so that active information dissemination can proceed.

Specifically, it will be necessary to actively work toward 1) establishing an information dissemination infrastructure so that average citizens can have access to atomic energy information in simple form when they have concerns or doubts about it and then perfecting the function through this and other means so that the release of information regarding atomic energy is more understandable, 2) the training of the information personnel necessary for grass roots information release, the polishing of intelligent lecturers whom the public trusts, and the establishment of software relating to public information, and 3) analyzing the public mood so that effective and constructive discussions about atomic energy can continue and perfecting research concerning effective means of communication.

(3) New Development of More Effective Public Information Activities

—Perfecting Public Information Which Is Prioritized by Objective

It will be important to release information with special emphases according to whether its object is women, elementary school children, middle and high school students, or opinion leaders who have a great impact on the formation of public opinion. In light of the fact that information from television, newspapers, etc. has a major impact on the opinion forming process, we will also have to work harder to disseminate information which is both accurate and timely to mass communications personnel.